

Aviation Week & Space Technology

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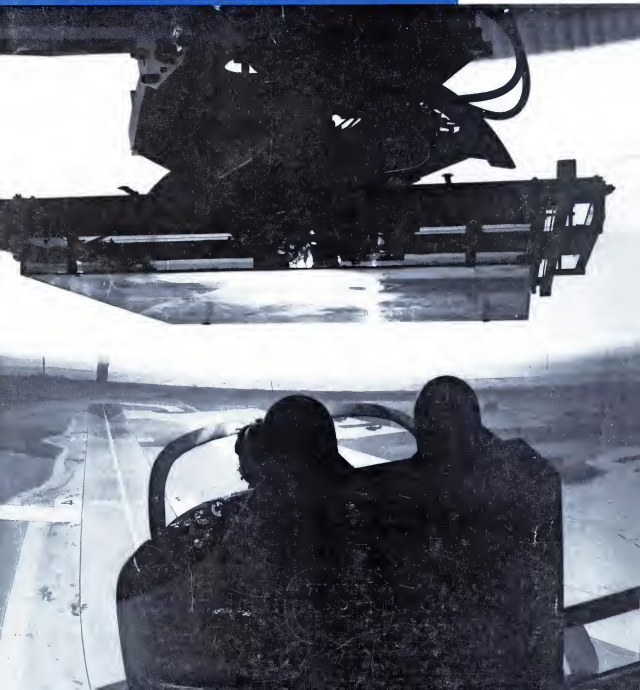
A McGraw-Hill Publication

January 21, 1963

SPECIAL REPORTS:

- MA-9 Tests
- XV-5A Details

Ryan Flight Simulator





Under development at Aerojet...

AMERICA'S MOST POWERFUL LIQUID-HYDROGEN-FUELED ROCKET ENGINE

The Nation's largest and most sophisticated liquid oxygen/liquid hydrogen engine is now under development at Aerojet-General's Liquid Rocket Plant. The engine, the M-1 space booster, which will deliver well in excess of 1,000,000 pounds of thrust to permit the launching of extremely heavy payloads. ■ As an integral part of the M-1 project, Aerojet-General® also is completing one of the largest test facilities in the world, including two 370,000 gallon liquid hydrogen storage tanks and teststands capable of handling boosters up to 3,000,000 pounds thrust. ■ The M-1 is being developed by the Liquid Rocket Plant for the National Aeronautics and Space Administration,



LIQUID ROCKET PLANT / Azusa, California

Blind Bolt[®] become part of simplified wing rework saving \$2.8 million!



Blind Bolt[®] being installed in RF100C lower tapered skin contour using torque tool after wing removal from rework pit. H Series Corp. portable power source (BNAQU) electrolyte for operating model shown, provides hydraulic power to the Blind Bolt Gun. Air operated model is non-sparking and safe for use on non ferrous aircraft or on non ferrous vehicles.

INSTALLATION TOOLING



**WING
REWORK
TOOL**
are used in primary
structure areas. Photo
shows instrumentally
isolated RF100C Gun.



**WING
REWORK
TOOL**
used in "hot" areas
from standard tools for
use in heat treating
or in cold beyond
standard structures.



**WING
REWORK
TOOL**
used in standard areas
to 30" or more to reach
into hard-to-reach
areas. Also in repair
work on cold areas
removal of structural
components in gun
rooms or in hot pits.



**WING
TOOL**
to insert blind bolts
in through holes and
blind flange through
holes in limited
conditions or for blind
flange or other power
equipment in heat
treatment.

Because of its ability to fill misaligned or oversized holes, the all-purpose, Blind Bolt[®] fastening system has become an essential part of a method developed at HRA F. Base at Dayton, Ohio to repair wings of RF101C fighter aircraft at depot level maintenance.

Since this unique repair method replaces only the tapered portion rather than entire wing structural assemblies, an estimated \$2,800,000 was saved during first year of a continuing program. With similar conditions, this method is applicable to other type aircraft, missile and space vehicle structure.

At first, engineering analysis indicated that major repair of the damaged wing patch was not feasible. Because of the problems of designing the hole patterns and varying tolerances between the original wing structure and the new factory panel, and yet retain the wing's original "fat," the wing seemed unsalvageable. Complete replacement of the wing seemed necessary to fly the powered aircraft again.

Fortunately, a repair method was developed by HRA engineers and shop technicians to transfer the exact hole locations of a damaged wing panel, by means of a drill locator and passed drill leading technique, to a new reinforced skin panel. The latter then was drilled with matching hole patterns, easily fastened with Blind Bolt[®] in the wing structure. When fastened, the reinforced wing showed no evidence of distortion. Thus, the repair was accomplished for the price of a skin panel rather than that of an entire wing structure.

For repair or modification, usage of Blind Bolt[®] and H Series portable structural disassembly fast production, they are useful for light structural stress, close-out joints and tubular members. For replacement purposes, self-locking Blind Bolt[®] and H Series match strength values of NAS bolts and nuts. And, important to repair work, Blind Bolt[®] are not grip loosening.

WRITE FOR 24 PAGE NEW CATALOG

Describes how to perform, identify and prevent, facilities test and blind bolts and Blind Bolt[®] in new work or for repair. Also describes advantages, applications, strength data, installation, techniques and testing.



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OFFERING MAXIMUM EXPANSION FLEXIBILITY AT MINIMUM COST

The Reliability of REAC Analog Computers has been proven through years of unmatched performance, with typical unscheduled down time averaging less than 3%.

The new REAC 500 carries forward the REAC tradition of built-in reliability. Put this proven performance to work for you. Let us help you with your present and future planning — it will be to your advantage.

For further information on the REAC 500, write for Data File 756.

Our field engineers who are making worldwide applications for their clients at sites of related facilities are also set to work with you.

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Reeves

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AEROSPACE CALENDAR

- Jan. 28-29th Annual Army Aviation Conference, Services Symposium, International (at Washington, D. C. Sponsor: National Aeronautics Research Area)
- Jan. 30-31st North Atlantic Military Meeting Conference, Annual Research Council of Elasm Institute of Technology, Chicago, Ill.
- Jan. 30-31st 1-4th Annual Solid Fuel Rocket Rocket Conference, Aviation Rocket Society, Bellevue National Hotel and The Franklin Institute, Philadelphia
- Jan. 31-32nd 1-2th Annual Winter Conference on Military Electronics Institute of Electrical and Electronics Engineers, Annapolis Hotel, Los Angeles, Calif.
- Feb. 1-2th International Symposium on the Material Sciences Symposium, Third Star Show Plaza, Boston, Mass. Sponsor: Star Corp.
- Feb. 1-2th Symposium on Engineering for Major Scientific Program, Georgia Institute of Technology, Atlanta, Ga.
- Feb. 3-7th Symposium in Microelectronics, American Society of Test and Measurement Engineering, Park Executive Hotel, New York, N. Y.
- Feb. 4-7th Meeting National Aerospace Standards Committee of the Aerospace Industries Association, Ambassador Hotel, Los Angeles, Calif.
- Feb. 11-15th Third International Symposium on Quantum Electronics, UNESCO Building, Paris, France. Sponsor: International Research, Radio Union, Office of Naval Research, La Jolla Research Institute, Los Angeles, California

(Continued on page 7)

WEATHER FORECASTING SPEEDED BY STRADAP



(Or: How to get a storm to look at the bird.)

Take heart, all ye birdies who haven't given up trying to outguess the weather. STRADAP is here!

This latest addition to cryptic meteorological means STRADAP Radar Data Processor. In brief, it's a specially-developed computer and reading system that may well revolutionize methods of storm observation and forecasting, and could lead to a system that provides complete, accurate storm maps of the entire nation on a real time basis!

STRADAP was designed and built by Budd Electronics working in close association with the AFCEA. The first system was put into operation late in 1962, at the AFCEA center at Saulters, Mass. STRADAP was hardly needed in its new home when it was overwhelmingly challenged by a blustering storm that produced two fatalities in the area.

STRADAP won. It detected the storm and displayed the details of its configuration as fast as the very system changed its face. While other techniques and storm systems have been directed by radar, this is the first time that radar observations of storm intensity and height were made available within moments of observation time.

Here's how STRADAP works. While the radar scans the skies, STRADAP measures the intensity of storm echoes and the maximum height of the storm. After each complete scanning, which takes about 3 1/2 minutes, STRADAP prints out two condensed maps. One is an array of numbers having the geographical configuration of the storm area, but with each number representing maximum intensity in each 5 by 5 mile sub-sector.

The second map is a similar array of numbers representing the maximum height of the storm in each 5 by 5 mile sub-sector. This is thereby a topographic map of the storm.

Because these maps are available every few minutes, meteorologists can follow the changes in a storm's structure rapidly and accurately, spotting and evaluating areas in which severe activity is brewing. STRADAP not only stores its data, transmits it or converts it to another station, or play it back for research. Other features include an alarm that can be set to signal specific weather conditions, and facilities for inserting code into outgoing messages.

You don't have to know much about present methods of weather mapping and forecasting to appreciate the significance of STRADAP. You may find even greater appreciation, however, in the fact that this system is another example of Budd's considerable experience and skills in data processing, display and transmission successfully applied to a specialized problem.

We'll gladly show you how our system can go to work on your data handling problem... tell you more about STRADAP or welcome you to the nearest office of the Budd Electronics Company & Marketing Society, Write for any or all of these reasons to Data Processing and Display Systems Dept., Budd Electronics, 45-21 Thorne St., Long Island City 1, New York.

"It may even enable us to give the long lost to the President's hypothesis of severe weather which made that 6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 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Microscopic photographs of small gas particles taken with high speed photo eyes.

At -100°F all rubbers are disappointing

except
silicone rubber

At 100°F below zero, other synthetic elastomers can hardly be tested, yet General Electric silicone rubber maintains excellent properties. For example, at -100°F, silicone rubber can offer elongation of 500%, tear resistance of 300 psi, and tensile strength of 10,000 psi (even better than at room temperature). As a matter of fact, G-E silicone rubber is consistently useful at -130°F, and infrequently to -250°F.



Radiation covers coated with G-E silicone rubber remain flexible at temperature extremes and provide long term protection for delicate radar. Silicone rubber molding protects against cracking at low frequency, stress, and aging and corrosion.



Young's modulus is known but otherwise unpredictable behavior of silicone rubber. Even after such periods of 24 hours silicone rubber is still useful below -100°F. Tensile strength and other properties show relatively little change from normal values.



Silicone rubber pad for liquid crystal computer display elements is critical to equipment. A series of impressions help insure uniform and predictable electron deflection characteristics at temperatures from -65° to 300°F.

GENERAL  ELECTRIC



Babcock, a leader in analog-type command guidance and stabilization systems, is now developing digital equipment that meets both the economic limitations and the more stringent reliability and accuracy demands of combat surveillance and missile target vehicle programs. By taking advantage of decreased bandwidth requirements and utilizing time sharing techniques, Babcock makes it possible to control several vehicles simultaneously from a single ground station installation without mutual interference. This development is another example of Babcock's basic ability to convert advanced techniques into low cost operable hardware.



AEROSPACE **BABCOCK**
DIVISION

BABCOCK ELECTRONICS CORP.
1640 Monrovia Avenue, Costa Mesa, California

THE ABC'S OF PCM

If you have been paying proper attention to our always-factual propaganda, you of course know that Telemetrics' Universal PCM Decom Systems have been field-proved for 30th hours at more than 40 major NASA, military and industrial installations.

But it should come as a pleasant surprise to learn that the modular building blocks of these almost-intelible systems are now available individually.

[illegible]

Take, for instance, our Model 900 Digital Signal Emulator, which produces a completely programmable coded output to meet practically all lab and field requirements. You can use it to check out and calibrate computers, digital communications systems, digital voice transmission processors, data systems and PCM telemetry equipment.

Then there's our Model 6103-B Digital Signal Synchronizer, to help capture wide frequency ranges of input PCM data from poor quality magnetic tapes and recover despite horrendous signal-to-noise ratios, burst line variations and rate variations. The 6103-B synchronizes time-multiplexed signals, converts them into RZ or NRZ form, and provides a clock signal as frequency and phase sync with the input data.

Another good example is our Model 6210 DAC Assembly. Individual plug-in modules accurately convert digital-coded information to proportional analog voltages, with 100 millampere output to drive both frequency phase-locked loops.

You'll find some little-known but very intriguing facts about all three of these components below. For the complete story, just ask for Data File 31A.

TELEMETRICS INC.



1. 這是在下學期，對學生所提出的「如何
改善校園生活」的調查結果。
2. 學生對校園生活的看法，與上學期
的調查結果，有很大的不同。

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TELEVISION (ENGLISH): Universal PCB Remodelation • Spring Tuning • Automatic F.M. Remodelation Kit

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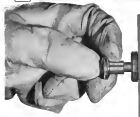
ability and superior performance. And can record 1.5 Mc of data at a speed of 120 ips. Ampex 9301 tape rounds out a recording system that gives you the highest frequency in longitudinal recording today. For more information write the only company providing recorders, tapes and memory devices for every application. Ampex Corp., 934 Charter St., Redwood City, Calif. Worldwide sales and service.



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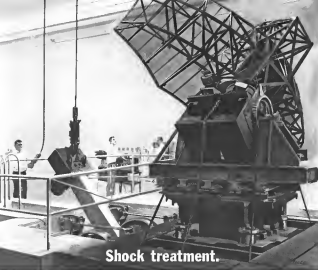
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14



Shock treatment.

Lockheed announces advanced environmental testing facilities available new to industry and defense.

Successful on-the-job performance of components and complete equipment can now be assured by thorough reliability testing in one of the South's finest environmental laboratories. At Lockheed Electronics, test engineers check out simple and complex equipment through extreme environmental simulations ranging from upper altitudes to the ocean floor. From sub-freezing to fiery hot conditions. From normal to violently explosive atmospheres.

The laboratory probes products up to and through their destruction points—recording and analyzing performance to enable designers to strengthen weaknesses that appear at any point during the rugged tests. Above, a large Lockheed shipboard radar antenna undergoes a

typical test simulating extremes of pitch and shock while a destroyer might experience.

Originally created to assure the reliability of Lockheed Electronics' products, the Lockheed Environmental Test Laboratory is now prepared to conduct standard tests or special evaluations for manufacturers of commercial or military products or equipment. Its technical staff can run single or combined tests to your specifications or your own personnel can attend and consult. All results are documented in concise technical reports. Security provisions permit environmental testing on projects classified through Secret.

For complete details write for a copy of Lockheed's test facilities brochure, "Environment in the Laboratory... a service to industry."

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EDITORIAL

The Mid-Course Budget

The Fiscal 1964 federal budget confirms that the aerospace industry faces several long and painful years (AW Jan. 14, p. 21). This budget calls for a \$7.5-billion effort in space technology, of which \$5.7 billion goes to NASA and \$1.6 billion for the military space program, and about \$6.2 billion in the defense budget for research, development, test and procurement of aircraft, missiles and weapons. Both of these totals are previous records and reflect the mood of the Kennedy Administration in aerospace. In the aerospace field, the worst effects of a deterioration in aid to the increasing fiscal burden of the administration the Administration has incurred and to channel its effort toward the land projects which it established earlier. In this respect it is a responsible budget, because in the military and space programs it should deliver what is required and promises no illusion, accomplishments are properly reflected by fiscal weight of hand.

In space technology, the hard priority is the Apollo manned lunar landing program, and the second NASA budget is devoted predominantly in the direction of the space. This actually means a reduced program in pure space science, and a less vigorous push clear across the overwhelming spectrum of flat technical frontier. There will certainly be criticism from Congress, the scientific community and the taxpayers of this thing of the available space dollar. But there can be no criticism of the Administration's duty of purpose in this space budget. It is putting its money where its mouth is.

The budgetary priority on the Apollo program for Fiscal 1964 shows which it will absorb about 45% of the total federal budget, a extremely significant. For while there is no guarantee of automatic technical success in any budget, this is the year in which a budgetary failure could have crippled the Apollo program beyond repair. The critical technical years still lie ahead for Apollo, but it can handle its most critical financial year if the final congressional verdict closely resembles the Administration's request. This level of federal support for Fiscal 1964 will at least assure that the staggeringly large capital will set in the race to the moon with the Soviet Union, whereas a budget more now would guarantee a second place finish.

The \$5.7-billion defense budget (see p. 26) contains no surprise for followers of the Kennedy Administration's defense policy and the philosophy of its defense program. Robert S. McNamara. It follows their original program of vastly increasing air force capacity, increasing and modernizing non-nuclear air force, including tactical weapons, and putting their major strategic force on par with the Polaris and Minuteman solid propellant ballistic missiles. However, the Fiscal 1964 defense budget faces squarely major procurement bumps that this policy has created and there appear to be no budgetary straitjackets in any of the key programs the Administration considers vital. There are numerous attack boats and hold-downs in programs other people, including leaders of the military services, feel are vital—in fact, since \$13 billion worth of weapons.

However much critics of the Kennedy defense policies

may disagree with their goals—and we must enter several dissenters—they will find it hard to criticize the Fiscal 1964 defense budget as a responsible effort taken to implement these policies fully and achieve these goals. For example, both the large procurement items for completion of the Army's weapons modernization program and the enlargement of the USAF Minuteman force could have been reduced in the current budget, and stretched over several years to keep this budget much closer to the \$50 billion plateau the Kennedy Administration originally envisioned. This would have significantly delayed the combat capability sought from both programs. But the full fiscal impact of these programs was absorbed in this budget to obtain the earliest possible combat equidates.

Historically, in view of the badly disrupted course of the manned activity since years ago for some late projects of the missile age, the largest single procurement in the defense budget is approximately \$6.6 billion for aircraft. Many programs in this category are what the defense officials term a "graveyard" for the McDonnell F-4H fighter consists in both Navy and USAF, and the Lockheed F-105—the redesign C-130 and the turbojet C-141. Major programs in the \$4.1-billion missile program are the Navy's Polaris, which will complete its program of 41 operational submarines in this budget, and the USAF Minuteman.

The \$5.7 billion research, development and test account includes \$2.3 billion for missile systems, including the advanced anti-ICBM Nike X, advanced Minuteman and new versions of the Polaris Second A-3, about \$700 million for aircraft including TFX and the XC-142 VTOL transport, and about \$1.5 billion for military space (an additional \$300 million booster procurement and construction is listed elsewhere).

Among the plans for the aerospace industry coming from the Fiscal 1964 budget are Skybolt, the BS-70 jet-powered administrative aircraft and the supersonic transport. These are some of the alternatives that had to be weighed against completing the Polaris and Minuteman program at minimum price, giving the Army an all-weather and replacing its World War II weapons with modern weapons. There can and will be argument over some of these choices, but again there can be nothing but admiration for the men who made these hard decisions instead of letting the defense budget continue its 10-year drift in a costly, ever-growing lump of strategically sleepless things.

The magnitude of the federal budget for space and defense in Fiscal 1964 places a tremendous responsibility on the aerospace industry which will do most of the research, development and production of the hardware required. It will require solid hard-wired management to discharge this responsibility to the taxpayer and citizen, along with equal responsibility to their stockholders. And it places greater emphasis than ever before on the government-industry partnership to find a workable system for adequately rewarding superior performance and punishing failure.

—Robert Hutz



new war-club for nation's arsenal

The Navy's Strike cruise is the first of a new breed of weapons designed specifically to increase air-to-surface striking power. Strike will provide a new attack capability against heavily defended tactical target areas, combined with increased protection for the Navy's pilots and aircraft under operational conditions. Texas Instruments is the prime contractor for the guidance and control sections of the Strike missile, applying skills in electronics and aerodynamics. TI contributes to

the development of this high-performance weapon more than 20 years' experience in recognizing and solving tactical performance problems. ■ In addition to its systems management capabilities, TI possesses a unique combination of patent skills in many areas of radar/sonar. Expanding from a broad research base, TI interweaves its various technologies to provide a continuous flow of improved products and services for its customers. Write Department 45.



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WHO'S WHERE

In the Front Office

North American Avianists' Space and its
Inheritance Science Division, Downey, Calif.,
has named the following as vice presidents:
Frank Coughenour—Advanced Programs Development;
George Jolly—Faulquier Program Manager; Dr. W. R. Laidlaw—Advanced
Study.

Honors and Elections

[illegible]

Office of Aeronautics, Research ID Kufu, United Air Lines, Dr. Hermann St. Kufu, NASA Office of Advanced Research and Technology, Prof. R. H. Miller, Mission Research Institute of Technology, Miami, Florida, Republic Systems Corp., In G. Ross, Cornell Aeronautical Laboratory, Ronald Smith, Lockheed Martin and Space Co., R. Dean Spurr, R. Dean Spurr Associates, George S. Tynell, The Martin Co., Walter C. Williams, NASA Mission Research Center.

The 1962 Clower B. Bell Award has been presented to Brig. Gen. Robert R. Williams, commanding general, in behalf of U.S. Army Aviation Center Ft. Rucker, Ala. "For development of the armed helicopter concept introduced to service by the UH-1B during 1962."

The 1963 Quaker's New Year Honors List (United Kingdom) nominated the word of a knight to James Stewart Priddy, chief executive and deputy chair

(Continued on page 136)

INDUSTRY OBSERVER

At Fresno State, Suzanne Deane has begun working on an extensive series of grants for studies of bicultural words, concepts for use by the ICIBS, that can be made available in the 1988-74 time period (see Note 5, p. 10). Coined English has been selected for a multi-national analysis, review study. International Business Machines and American Bank's Joint Pacific Studies of the Global Computing world, business culture and M. S. Smith, and Sperry Rand for the direct word, culture review. Space Technology Laboratory will continue the basic analysis study.

► Proposals for analytical and experimental studies of potential nonfrictional problems associated with Acropore Plume will be submitted to industry competitors to Air Force's Aeronautical Systems Division by mid-February for contract award in March. Progress, personnel detailed (AW Jan. 7, p. 23), will include divergence and angle of attack studies in a wind tunnel of about March 8-5 to March 6.

► Probable segment of risks in the Apollo lunar landing program will have one of the two new members of the lunar evasions module (LEM) ascend in the capsule to provide a communications link between the second instrument on the lunar surface and the external mother craft and earth stations.

• **Pratt & Whitney** PW535 restored thrust engine for the Hawker P.1127 VTOL fighter will be delivered to Hawker Aircraft for flight testing this spring. The engine will produce 15,000-lb thrust. The aircraft has been flying with 14,000-lb thrust engine since the Farnborough air show (AW Sept. 17, p. 54).

*Design parameters of the Arrow Missile Command's Lance series. (For much Missile 80 anticipated an operational altitude capability of about 15 mi. During initial portion of powered flight, accelerations peak loads will not be less than 10g and may be high as 30g. Storage life of the missile may be as long as 10 yr. in a temperature variation from -55°F to +155°F.)

■ NASA has reported design studies of an electronic equipment complex to reduce raw data from three space flights and ground tests for its Managed Spacecraft Center automatic data reduction facility, to be built at Glenn Lab., Tex. New facility will handle large data reduction problems relating to Gemini and Apollo flights, space environment tests, astronaut training devices used in the centrifuge and other equipment testing. Copy of the NASA report is available for release at Central Station Procurement Office, NASA Western Operations Office, Santa Monica, Calif., and NASA headquarters, Washington, D. C.

► **Linear Excursion Module (LEM)** being built by Grumman Aircraft Engineering Corp. for NASA will be designed to execute its mission without the requirement of a base logistics vehicle or descent systems aids, such as horizons or reflectors. Design will be kept flexible enough, however, that LEM will be able to use those other systems if they are developed in time for the initial landing and if it is felt that they will contribute to the overall probability of success of the flight.

NASA is planning to install approximately six disks and lights of the go/slow type in the Agena stage to be used as motion simulators of the flight of the Gemini spacecraft. The instrumentation will interface to the Gemini crew console. The instruments will indicate to the Gemini crew the condition of the Agena, after rendezvousing and docking of the two units has been accomplished. They will show how much fuel remains in the stage, gas pressure levels and the status of electrical, hydraulic and pneumatic systems. By monitoring this instrumentation on the forward end of the Agena (the end which mates to the Gemini spacecraft) NASA will eliminate the requirement for an electrical interface between the stage and the Gemini spacecraft. The interface between the disks and the Gemini crew console will be absent on this.

Soviet Nuclear Threat

Soviet scientists "have worked out a 100 megaton bomb" but their calculations show that it "must not be smaller than 500 megatons" because the explosion would affect the East German Communist Party congress last week. The weapon can be, and "only, attack the countries of Europe," Khrushchev said. The yield of 100 megatons is a limit only from the point of view of military efficiency, he said.

Khrushchev said otherwise by foreign scientists and military experts are that the U.S. has "roughly 45,000 nuclear bombs and warheads," and "nuclear losses that the Soviet Union has has more than enough of this stuff." What would happen if all that nuclear armament were dropped on human heads? As the result of the first blow alone, 700 to 800 million people would have perished. All the big cities would be wiped out or destroyed not only in the two leading nuclear states—the U.S. and the Soviet Union—but also in France, Britain, Germany, Italy, China, Japan and many other countries of the world.

New AIA President

Karl G. Hart, Jr., a 40-year-old New York lawyer who served in defense and security posts under the Eisenhower Administration, has been named president of Aerospace Industries Assn. He is expected to take office about Apr. 1. The job has been open since last Mar. 15, when August G. Eberwein retired because of ill health. George F. Hunsman, vice president, has been acting president. Since 1960, Hart has been associated with the law firm of Rogers, Elger and Ellis in New York City, working with clients in the aerospace field. He was special assistant to the undersecretary of state for administration, deputy assistant secretary of defense for international security affairs, and special assistant to President Eisenhower for security operations coordination between 1954 and 1961. Hart is a magna cum laude graduate of Princeton University, a graduate of Yale Law School, and obtained his doctorate as a Rhodes Scholar at Oxford University.

U.S. and Indian officials have discussed the transfer of two Indian-owned Jupiter intermediate-range ballistic missile squadrons from India as a part of the modernization of North Atlantic Treaty Organization weapons systems. Jupiter's targets probably would be assigned to Polish submarines.

Space Council Funds

National Aeronautics and Space Council is asking for an operating budget of \$521,000 for fiscal 1964, a decrease of \$7,000 from its current amount. The bill will remain at 32, and \$491,768 of the request is for salaries.

Dr. Edward C. Weick, the council's executive secretary, continues to be outspoken on space expenditures and other controversial subjects. Referring to estimates two years ago made to the cost of the space program, Weick told a luncheon audience here that "there are bound to be stupid people in every field, just because they're labeled scientists doesn't guarantee them from being stupid."

Lockheed JetStar and North American A-5A will be used by National Aeronautics and Space Administration in the coming year to study supersonic transport operating problems. NASA is buying the JetStar to study it for use as a variable stability aircraft for control studies. It will be delivered in July. The A-5A was built from the Navy and will be used in studying problems of the transport crew and air traffic controllers during takeoffs. Both aircraft will be based at NASA's Flight Research Center, Edwards, Calif.

Telstar, Relay Hearings

Procedures of the American Telephone & Telegraph Telstar and Radio Corp. of America-developed Relay communications satellites will be explained by the Senate Commerce Committee here in a public hearing.

A week later, the U.S. incorporation of the Space Communications Corp. will be studied by the Rand Corp. on the economic as well as the technical aspects of a world-wide operational network. Rand founded the study itself.

One highlight of the new NASA budget request (see p. 29) is a \$5-million item to begin work on an Electronics Research Center in the Boston, Mass., area. It is expected to cost 550 million and employ 2,000 specialists. NASA has no other center devoted solely or chiefly to electronics among its 17 institutions.

Kennedy Administration is trying a creative federal aid program for colleges and universities into its space and defense efforts, which may result many of the sciences. Congress has to granting direct aid to schools. Legislation is being drafted to implement current and recommendations of the House President's Science Advisory Committee report, which said that "impending shortages of talented, highly trained scientists and engineers threaten the successful fulfillment of vital national commitments." NASA also is developing a large program for converging scientific and engineering training.

—Washington Staff



Army XV-5A* provides maximum range/payload

Scheduled to fly in mid 1963, the Army XV-5A* tilt fan research aircraft will provide greater payload/range capability than any other high performance V/STOL system.

Now being designed and built by Ryan Aeronautical Company, under contract to General Electric, the XV-5A* aircraft will be powered by two J85 jet engines which drive submerged wing fans for vertical flight. This unique concept provides two to three times more lift, for a given amount of installed engine thrust, than any other high speed V/STOL design.

Result: Greater payload/range capability—less fuel consumption and need for logistic support. Because the lift fan system multiplies engine thrust by 300 percent, for vertical flight, XV-5A* engines can be used for most efficient hovering and cruise conditions and do not have to be oversized to meet V/STOL flight requirements. These inherent and designed advantages give the XV-5A* performance which meets anticipated requirements for military missions.

* FORMERLY XV-11

RYAN AERONAUTICAL COMPANY, SAN DIEGO, CALIFORNIA



Conventional XV-5A* cockpit permits pilots to fly through turbulence without moving head or feet toward control area.



Low payloads and low requirements of lift fan offset provide slight advantages for operation from unprepared sites.

RYAN
AEROSPACE

RYAN'S SPECTRUM OF CAPABILITIES





One of 16 Bell UH-1B Huey helicopters fitted with Electronic M601 pod (not installed in its delivery to Army's Utility Tiltrotor Helicopter Company in South Vietnam). Army procurement bid H 330176 in South Vietnam.

Bell UH-1Bs Fitted With Traversing Turret

Turret mounts in UH-1B can fire M60 7.62 mm machine gun from each side of the fuselage which fire the short NATO cartridge (AW 100, p. 78). Gun can be traversed from 42 deg. forward to 70 deg. aftward, depressed 61 deg. and elevated 8 deg. Elevation mechanism has through rotor flow. Slowing down to be checked in flight. Sticks visible at end of gun in this photo, have been deleted in production models. Total weight (empty, including gun control equipment and 6,000 rounds, is approximately 800 lb. Fire control system, also built by Eldec, was Eldec's, is mounted from cockpit overhead on complete field side of cockpit. Eldec's design opened rotor gearshift-governor to cock target without the turret being repositioned toward it. Total gun can track gun. Electronic Eldec's contract to fire on the rotor flow turret was that 35.5 inches. System can be quickly removed by jacking bolts at forward towards to each side of the helicopter fuselage.



West Germany Cancels T-38 Plan

Basic West German air force is cancelling long-standing plan to order a quantity of Northrop T-38 two-seat advanced jet trainers in the wake of a decision to transfer the bulk of its cadet pilot training activities to the emboldened U.S.

Under the plan initiated by Lt. Gen. Werner Frenckh, now an Air Force inspector general, West Germany will abandon its buildup of a national training program in a course designed to save both time and money (AW 100, p. 79).

At an estimated rate of about 60 per cent, the air force's new cadets will be sent to the U.S. for approximately 18 months of flight training by U.S. Air Force instructors. Probable training site is George AFB, Calif.

West German air force officials originally considered a plan to follow through with the purchase of the T-38s, leaving them in the U.S. as well as West German cadets, but later opted for a compromise version. Now, the students will train in USAF Cessna T-37s and T-38s, with West Germany paying for the training and use of the equipment on a graduated package basis.

Upon their return to West Germany, the pilots will be given 25-50 hr. of navigation and all-weather flight training before being assigned to front-line roles as opposed to recruits.

New Missile Site Helicopter Bids Sought; Requirements Are Eased

Washington-Air Force has relaxed strategic requirements for its IX-11 missile site support helicopter in a new request for proposals sent Jan. 18 to three manufacturers. Proposals are due May 15 and a winner is to be selected in April.

Kennedy Aircraft Corp., Bell Helicopter Co. and Sikorsky Aircraft Division of United Aircraft Corp. were told that their proposals, submitted last month for an off-the-shelf, single-engine, 10-passenger helicopter did not meet Air Force needs.

Original specifications, sent to manufacturers last November, allowed no substitutions in rotor engines, different

tail rotor, etc. In the original SOR 156 which led to the IX-11, the Air Force wanted engines in a new request for proposals at least 500 hp and 10-passenger at least 500 hp and 10-passenger. Internal differences over requirements were resolved when a decision was made to specify a single-engine helicopter in the medium weight range.

While the specifications were being drawn, the Air Force designated the aircraft the IX-11 for budgetary purposes. The Fiscal 1963 budget included \$600 million for the purchase of 15 aircraft.

To save money, it was hoped that a helicopter already in production could be bought. The Bell UH-1A, Ka-50 H-15 and the Sikorsky S-61 came under fire for not being to meeting the specifications.

Air Force is also considering the IX-12 heavy helicopter program to a single site support program, after announcing Jan. 7 that it would claim its Texas Tower radar island at two locations off Massachusetts in late February. The IX-12 originally was intended to support the towers (AW 100, p. 68).

The Air Force also had to change its mind engine Sikorsky CH-53 helicopters to service the radar towers. Those first-run aircraft are based on the Navy anti-submarine S-61A without the ASW equipment. Now the program has been reworked, the additional 22 aircraft to be bought will be modified version of the Sikorsky S-61B, transport, which has a larger fuselage. It will have doors for air loading and will be designated CH-53C.

The IX-2 program assigned from SOR-190. In the first competition, last year, the Air Force announced that the Vertol CH-46C had been chosen for the tower support mission. It was later

changed to the CH-53A when it was found that Vertol could not meet all heavy schedule and cost targets (AW 100, p. 49).

The new IX-2 was originated for budgetary purposes. In Fiscal 1963, \$111 million was allotted for 12 aircraft. The larger total of 25 aircraft results from reprogramming of funds available in Fiscal 1963 and additional requests in the Fiscal 1964 budget requests.

Compulsory Defense Arbitration Law Urged

Washington-Sen. John L. McClellan (D-Ark.) last week urged legislation providing compulsory arbitration of labor disputes at key defense plants and installations in situations at the Boeing Co. and Lockheed Aircraft Corp. approached cross strikes.

A strike at Boeing could be as night Jan. 15, was averted at the request of William Sullivan, director of the Federal Mediation and Conciliation Service. Management and labor agreed to maintain the status quo and contract negotiations at least until next week (AW 100, p. 73).

Meanwhile, what was known for the first negotiation attempt in the Lockheed case, failed. Under Tilt-Hartley Law, a vote by workers on a final or no agreement proposal is scheduled during the first 15 days of lockout. Since Tilt-Hartley was enacted in 1947, the pattern has been workers to accept the first offer. In the Lockheed dispute, the only agreement case in which the law has been in effect, will be a test case for the industry.

Sen. McClellan stated as a speech on the Senate floor that at the end of the 30-day "no-strike" maximum period, which was provided in the Lockheed case last Dec. 1, "then will be no authority under existing law in which to insure the continued production of the Polaris missile and our principal anti-submarine asset." I submit that this action should not permit its failure to be thus jeopardized and possible, in case necessary, to be then imposed.

In the past, however, arbitration has been adequately opposed by both management and labor.

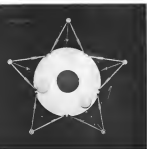
Sen. McClellan reported seven major work stoppages involving 675,437 man-hours lost at defense plants during 1962. Five in the aerospace field were: Sperry Gyroscope, 51,478 man-hours lost; Republic Aircraft Co., 47,202 man-hours lost; National Aeronautics and Space Administration, 35,000 man-hours lost; General and Aero's Wright Commercial Headquarters, 6,910 man-hours lost; Aero-GenCorp Corp., 17,762 man-hours lost; Lockheed Aircraft Corp., 37,800 man-hours lost.



Model Photos Show LEM Configuration Details



Lunar excursion module (LEM), being built by Grumman Aircraft Engineering Corp. for National Aeronautics and Space Administration, will consist of two basic sections, which will separate when astronauts leave the lunar surface for the return trip to earth (AW Nov. 26 p. 56). Top are three, upper left, contains view system. Below 15-ft tall LEM is shown upper right including lower structure which contains descent engine and landing gear. This structure serves as a lower launch pad and is left behind. Models of human figure in photos give relative size of vehicle. Both top photos are from the LEM's right. Photo at left is of LEM's rear. Large cross-shaped objects with ball centers are reaction jets for control. Smaller, Y-shaped antennae, visible in most pictures, are for radio communication. Tail antenna mounted just behind top exit port is for constant cross between LEM and astronaut walking on the lunar surface. Front view of LEM is shown below, right. Note perforated rectangle below front exit port, which is exit platform to be used by astronauts. Bottom view of LEM, below left, shows star-shaped landing gear and descent rocket exit point in center. Disk-shaped object mounted on bottom is a radio altimeter antenna. Object mounted on end of left exit of vehicle is a television camera.



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TACTICAL WEAPON SYSTEM
 Only Mach 2 fighter bomber with heavy air air, capable ground strikes call 2800 mhu/day. Fully computerized radar, fire and target control unit. First small defense specialist (SAS) 24 hrs 7 days/week. Visual, audio and computerized air, land or sea weapons, weapons, ground targets, 360° view of battlefield, air, land, sea, and sky. Available NOW. F-105D Thunderbolt, Grumman Aircraft Corp., Baltimore, Md. 21146.

AIR TRANSPORT

Supersonic Transport Program Stalled

Budget provides no work funds; NASA cuts research request; Halaby says study report is "incomplete."

By James R. Ashlock

Washington—Disappointment of a U.S. supersonic transport has become measured as federal budget reductions among President Kennedy's top cabinet members.

Hopes that the program would secure vigorous attention were dashed with disclosure that the President's Fiscal 1964 budget contained no appropriation for supersonic transport work. "The project was obviously included in President Kennedy's reference in his budget message to reduction or postponement of more desirable programs," as reported by his top two aides. In the same message, however, President Kennedy said that he still felt supersonic transport development should be expedited.

Federal Aviation Agency officials also said that they felt more planning should be done before submitting a budget request for supersonic transport development.

Hope also was diminished that an Administration decision on the report would be made by late 1963, as predicted by the President when \$31 million was authorized for the project in Fiscal 1962 and \$70 million in Fiscal 1963.

National Aeronautics and Space Administration now feels that its fundamental research into the general supersonic transport design is completed and that it can go no further into specific design work until FAA and military have selected a configuration.

Request Cut

Consequently, NASA cut its request for supersonic transport research from the Fiscal 1964 to \$3.8 million from \$4.3 million authorized in Fiscal 1963. It is unlikely that over these funds will remain in the program unless a realignment change is made sometime this year.

The President's budget message came two days after an FAA report, prepared by a special 11-man advisory group, was issued on the supersonic transport, backing a "two priority program."

The advisory group headed by retired Air Force Gen. David R. Cook, said that "expedient development of a conventional supersonic transport is vital to the national interest" and called for "a rapid and unambiguous" by the highest level of government to proceed.

In a letter accompanying the report, Gen. Cook suggested the report be "delivered at once in vigorous action to obtain from the Congress the author-

ity and funds required," saying this was crucial to develop a "feasible, desirable, and sound" program. However, FAA Administrator N. L. Halaby felt that the report was incomplete.

The picture is still incomplete and unclear, and request refinements be done, a Halaby decision could be made. Cook's and Halaby's views are being discussed by the President's Fiscal 1964 budget committee.

Halaby stressed more emphasis in the area of development and operating costs. Specifically he requested cuts in development and testing up to the manufacturer, stop direct operating costs and management organizations for supersonic transport development.

Congressional members, other government participants in supersonic transport work were evident as reports by Sen. Norris Cotton (R-N.H.), a member of the Senate Commerce-Airport Subcommittee.

"Finally, I am assured that this program represents a serious study plan, rather than one able to fly soon after the Atlantic as the continent, and was disappointed of its status in the current problem of operational costs," he continued.

"I believe the Senate aviation subcommittee will want to go into the job just as fully as the House, but recommending such a massive commitment of federal funds," he continued. "We need to solve the whole range of problems involved, including such things as the cost of additional air traffic facilities, the cost to the airlines and their passengers, as well as the structure of the federal government in the development of such a plane."

The advisory group recommended that an aircraft of March 23 be

March 23 (190,000 mph) be considered. Range of initial models should be 2,000 miles with a passenger capacity of 100-150 passengers. A 100,000 lb. or less gross weight was recommended, "with emphasis on light, skid land which allows operation at airports now used by large subsonic jet aircraft."

Certain technical questions remain to be solved. Gen. Cook said, "Air traffic, such as some losses and increasing costs."

Development costs were estimated to total about \$1 billion. A total of \$1 billion in operating costs was estimated to be needed for commercial service. In 1972, the report said. Price tag of each plane is estimated about \$10 million based on sales of 200 units. The government would seek to recover most of the development costs through royalties on aircraft sold. Gen. Cook estimated that the results would be about \$3 net per airplane.

Without enough speed, the advisory group said the aircraft should be designed around "maximum operating costs" instead of "maximum speed."

Engine needs, effect of speed on aircraft, and the need for a project vehicle to be obtained, that will result in some compromise at ground level that will be acceptable to the airlines.

Anglo-French Decision

Consideration of these factors was a guide to the decision by the French and British decision to hold the speed of their fourth large supersonic transport to Mach 2.2 (AW Jan 7, p. 42).

General performance requirements should be established such as 1962 and engine and airframe design competition should be held as soon as possible thereafter the study group said. Two engine and two airframe manufacturers would be chosen in early 1964 to develop competing designs, and the final selection would be made out of the 1967 flight test.

The feasibility is not open, however, said certain approaches will be developed and tested.

Aircraft would have to be of steel, titanium or similar metal construction, the report said, since March 23 appears to be the last possible date for the development of such a plane. The advisory group recommended that an aircraft of March 23 be

Two KLM Directors' Posts Abolished

The Hinge-KLM Royal Dutch Airlines is planning to drop two management positions from its line in a two-year plan to cut its operating expenses.

More likely the resignation of KLM President H. H. van der Berg and that of the company's two executive vice presidents (AW Jan 14, p. 41). The action also apparently coincides with the announcement made by KLM and KLM's parent, a New York management consulting firm, after a study of the company's personnel and operational structure.

New management will include at least one, and probably two directors named from outside the company structure. One senior advisor already has been named—H. H. van der Berg, managing director of Shell Dutch of Rotterdam before his appointment, who apparently has the primary task of putting the airline's complete total to a general review before the end of 1963.

Other advisors named last week by Hinge-KLM include KLM deputy president van der Berg, and Louis de Boer, the managing director vice president. Former members of KLM are to be named from outside the company, as was Louis de Boer, who apparently has the primary task of putting the airline's complete total to a general review before the end of 1963.

Appointment of Louis de Boer to KLM's current financial position, possibly by taking over a share of the Dutch government's shareholdings, which now represent 60% of the total stock. These reports were denied last week by a KLM spokesman.

Subsidy Drop in CAB Budget; FAA Seeks \$810 Million

By L. L. Doty

Washington—Civil Aeronautics Board prediction of a downward trend in federal subsidies paid local service airlines was reflected last week in a \$1 million decrease in CAB's total fiscal 1964 budget request.

At the same time, Federal Aviation Agency asked for a \$810-million budget for the same period, a \$57-million increase over 1963.

In his budget message to the Congress, President Kennedy called for greater advance on competitive free enterprise, with less federal regulation and subsidies in the transportation industry, a position he took last year. He also repeated a request for adoption of cost changes for commercial and general aviation (AW Jan 22, 1963, p. 42).

The CAB budget request, which totals \$919 million, indicates that \$60.2 million will be paid the 13 local service airlines in Fiscal 1964, a \$3 million drop from the estimated amount for Fiscal 1963. A total of \$5.7 million has been asked for the three helicopter airlines for Fiscal 1964, compared with \$5 million for Fiscal 1963.

Subsidies paid to Alaskan carriers will climb to \$8.2 million in Fiscal 1964, compared with the \$5.9 million for Fiscal 1963. Operating operations will cost for \$80,000 in Fiscal 1964, compared with \$3 million this year. The 11 U.S. domestic airlines and the 17 common operating international carriers are not subsidized.

FAA budget does not include a request for funds for the development of a supersonic transport, for which \$20 million was appropriated in Fiscal 1963.

In his message, Kennedy said: "Studies are, preparing on the economic and technical feasibility of developing a supersonic transport. I have directed that the studies be expedited and the results evaluated as soon as practical."

FAA explained that the studies will be completed and results submitted "later this year." It said that funds are being requested at the time since the development of a supersonic transport would have far-reaching economic and social consequences, and a final decision should be made before the studies are completed to avoid the possibility that the studies are expected to yield two or three.

For the fiscal year, the FAA request for new additional outlays is in the operation of the agency. Total request for this activity is \$545.5 million, an increase of \$55.1 million over the \$490.4 million sought for Fiscal 1963. Annual expenditures were \$429.2 million in Fiscal 1962.

These are the principal items contributing to the increase:

- **Training of 986 new personnel** personnel positions completed with a net gain of 100 and the beginning of three new insurance contracts.
- **Operation of new facilities** that will be used for more under authority of prior year appropriations. Total of \$3

long-range under have been funded through Fiscal 1963 and an additional one authorized for Fiscal 1964. Funded air traffic control centers total 706, with five more proposed for Fiscal 1964. Funded Tower facilities total 711, with 90 additional proposed for Fiscal 1964. Funded VOR-2100 facilities total 183, and 18 additional are proposed for Fiscal 1964. The current 272 standard approved lighting systems funded through Fiscal 1963 will be increased by 13 in Fiscal 1964.

• **Increased emphasis on the establishment and improvement of Civil Air Regulations and on the airport ground safety program.**

• **Finding of the Aircraft Maintenance Inspection Service for the Air Force.** KLM officials requested that 25% change on passengers, an additional 15% on cargo above 100 lbs. up to 250 lbs. on jet fuel and an increase from 2 cents to 3 cents per gallon of fuel for general aviation aircraft will yield an overall cost of \$153 million annually, and help to cover operational costs of airports and navigational facilities.

FAA expects for facilities and equipment expenditures of \$127 million, an increase of \$2 million over the previous year. The request includes \$15 million for the construction of personal buildings at the National Aviation University Extension Center in Dallas, Tex.

It also includes \$12.2 million for the government of three Government Civilian aircraft and one jet turbine.

For the first time since Fiscal 1957, fiscal 1964 will include a provision for the use of air traffic control and navigation equipment developed. FAA needs \$99.5 million for this program, compared with \$115 million appropriated for Fiscal 1963.

FAA, however, anticipates future increases in budget requirements in the area of airports that have been developed in the agency's research group.

For research and development, FAA has requested \$10 million, an increase of \$15 million over the amount appropriated for Fiscal 1963. The \$10 million will be used for research and development of new facilities, such as air traffic control and air navigation facilities, \$12 million for aviation weather program, \$4.8 million for safety research, \$1.2 million for reports and \$1 million for aviation medical research.

FAA, which has problems over the two Washington D.C. airports—Dulles International and Washington National—has requested \$5 million for the operation of these two facilities in Fiscal 1964. An additional \$4.5 million is being asked for improvements at the two locations, including the addition of seven new mobile lounges for Dulles at a cost of \$2.1 million.



C-141 Fuselage Sections Ready for Mating

Forward section and nose fuselage section of the first USAF Lockheed C-141 StarLifter turboprop aircraft are placed side by side for mating at Lockheed-Gomco Co. in Marietta Ga. Two sections total 115 ft. in length, one-half length will be 141 ft. after addition of rear section and tail section. For each C-141, two additional photo, one p. B15. First flight is scheduled in December.

CAB Must Rule on Panagra Ownership

Washington—U.S. Supreme Court has refused to answer what it says is the Civil Aeronautics Board's request for landing problems among out of Pan American World Airways and W.R. Grace & Co. ownership of Pan American Grace Airlines.

In the decision issued last week after a 5-2 vote, the court reversed a District Court ruling that Pan American must divest itself of its 99% ownership in Panagra.

"We think the narrow questions presented in this complaint have been entrusted to the Board and that this complaint should be dismissed," the court order said. Accordingly, the court ordered the judgment and awarded the case for proceedings in conformity with the opinion.

Justice William J. Brennan, Jr. and Chief Justice Earl Warren cast the dissenting votes, while Justices Thurgood Marshall and John M. Harlan dissented.

The high court also said that the CAB has the power to act in other cases of the Panagra case without Supreme Court intervention. CAB had appealed earlier through the Justice Dept. but a Supreme Court ruling on whether to take jurisdiction changed against Pan American last August with against Panagra. This went to the Supreme Court along with Pan American's appeal to the District Court ruling.

CAB evidently was uncertain of its authority in the matter because it is now involved protracted the process in 1955 of the Civil Aeronautics Act. The Board apparently also wanted clarification of its authority under W. R. Grace & Co., which is primarily a shipping firm and whose stockholders' interests could

be affected by CAB action, such as its order for Grace to divest itself of its Panagra holdings.

"It is clear that the Board has jurisdiction over airline practices and on fair methods of competition even though they originated prior to 1935," the court said.

"What was done in the pre-1935 days may be so disruptive of the system established by the Act as to not harmonize with the statutory standards for competition that it should be redressed."

Referring to suggestions that the CAB's rules and don't "pose a dual standard to airline companies," the court said that the CAB's rules are not intended to be applied to the CAB's rules, but the court said that the CAB's rules are not intended to be applied to the CAB's rules.

"Where the guidelines have been the product of the Board, in the operation of a system of regulation, the allocation of routes and the affiliation of common carriers with its carriers. Congress must have intended to act in a way that was intended to deal with the CAB's rules, but the court said that the CAB's rules are not intended to be applied to the CAB's rules."

In its ruling, CAB charged that Pan American and Grace formed Panagra in 1928 or 1929 on a monopoly and act on routes which, the two airlines would not compete between the U.S. and South America. It also charged that Pan American and Grace conspired to monopolize air commerce between the entire central area of the U.S. and western coastal areas of South America.

Pan American also charged with using its 99% control over Panagra to prevent it from serving CAB-affiliated to extend its routes from the Panama Canal Zone to the U.S.

Disagreement over Panagra's route extension is a key factor in the difference that have gone on recent years between Pan American and Panagra. It was a basis for the District Court case in which Pan American was ruled against in having violated the Sherman Act by suppressing Panagra's efforts to extend its routes.

Justice Brennan, in explaining his dissenting vote, said the court was establishing a bad precedent in its ruling.

"In its action today, the court subjects the industry to a conspiracy of anti-trust controls that Congress can hardly have contemplated," he said. Brennan was dissatisfied of the court's refusal to take the case which, to him, clearly involved a question of anti-trust violation. He cited other cases in which this point was the basis for Supreme Court intervention.

"I do not know upon which to withhold questions of route allocation, territorial division and combination between common carriers and an action from judicial review," Brennan said. "I do not see how the court can be justified in its action to refuse to act on questions of route allocation, combinations between common carriers, and other serious anti-competitive practices."

"In what logic," Brennan asked, does a conspiracy to fix routes go down to the heart of the regulation which is a conspiracy by its very nature?"

Brennan said CAB has jurisdiction for not proceeding against Pan American unless it can proceed against Panagra. "But in all events, the courts' time is now to such in an ideal time as it is already unduly prolonged," he said. "Because said."

CAB Cites Severed Wires in 707 Crash

Washington—Several wires in the middle torso area have been labeled by the Civil Aeronautics Board as the probable cause of the May 1, 1962 crash of an American Airlines Boeing 707-120B at New York International Airport. All eight crew members and 53 passengers were killed.

The CAB accident report issued last week said crew, cabin and mail could have been killed because of a malfunction of the rear wing, caused by a short circuiting of severed wires in the torso area.

Investigators speculated that initial damage to the wiring may have severed electric lines controls at the Boeing Corp.'s Edmonds-Pennell Div., Teterboro, N.J. A spokesman there was found to be among factors in performing the right-wing landing wires in the report, and, CAB feels that the wires were damaged by jacking.

"It is believed that the wires strain in the jacking of the wing, broke control wires that were damaged, but not completely severed, to be worked down and weakened to the extent that vibration and other disturbances were a period of time caused their final separation," the report said.

Separation of the severed wires and

severed that two of the eight wires were severed and a third was hanging by a single strand. Nine wire separations at least only the severity of the severing wires is consistent in the author. But control of the severed wires would cause in this short circuiting in sudden sudden deflection either right or left, the report said. The American report called for the left deflection, playing out January 26 months after the crash.

This appears to have happened at 10:05:12 G.M.T., where the severed wires and severed cables indicate the start of an emergency," the report said. CAB investigators said that when the light was detected the problem and took corrective action within a matter of seconds, wires would have been repaired, in the 1,000 ft. of available altitude. Examination indicated that the middle torso was damaged post before ground impact, as the cables not detected 707. In the right wing changes was also damaged, but cables were not cut 21 sec. after mid-fracture. Autopsied dissection failures on both ends of cables were disposed.

Early assessment of the condition would have been hazardous, the CAB said, in detecting indicators such as diagnostic procedures, radio communications. Top attractions, turbulence, lack of forward horizon reference, because of the acute high altitude and loss reference to altitude instruments because of excellent weather conditions.

"In all recorded instances of low altitude malfunctions in emergency, descent, the crew was late in recognizing the symptoms as being the cause of the problem and was slow in initiating corrective action," the report said.

CAB discounted a Federal Aviation Agency theory that a bolt in the rudder bottom passage may have failed and, leaving its handle loose and forcing the rudder to a full left deflection. The bolt in question was not recovered by salvage. However, CAB officials said accident investigators indicated no loss of bid-rudder pressure, and that a wide-scale examination of Boeing 707 aircraft showed all bolts properly secured.

Concerns that the servo and was at fault was strengthened, CAB said, when drawings revealed that based on the American type servo was discovered on the wiring of other units.

"The fact that numerous servo units were found on the assembly line with similar damage and markings is considered to be consistent evidence that the damage was initiated by assembly or



First Jet Commander Prototype Rolled Out at Norman, Okla.

First jet commander prototype 1211 jet Commander first jet commander prototype was rolled out at Air Command's Norman, Okla. Development facility last week. Aircraft is powered by two, six-cylinder General Electric C-143 turboprops and will carry 100-1000 military cargo, including personnel and equipment. Production aircraft will be built at Bethpage, Okla. (APR 11, p. 99)

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Pioneer-Central Division



Ethiopian, as are 15 out of 36 ground operations employees.

Pilots have come from either the Ethiopian Air Force or the National Airline Training Project, a segment of the Point Four economic assistance provided by the U.S. Almost the only source of mechanics has been an ICAO training program, which has provided 80 mechanics from a theoretical instruction course. Others have come from the air force and a few from a Point Four course for maintenance mechanics.

At the time, the Ethiopian pilots fly most of the DC-8, DC-7, C-47 and CV-340 schedules and the rest of the aircraft building on equipment supplied the same at EAL as it does on any U.S. airline. Six Ethiopian pilots have completed training with the Boeing Co. in Seattle, Wash., and TWA's simulator course at Kansas City, Kan., for future jet assignments. The only major difficulty, according to the airline, has been in training flight engineers for the 738.

None of the EAL employees is currently untrained but adds a recent decree of the emperor, who believes in the democratic principles of education, beginning labor unions will be organized in the near future. EAL considers this a wise move, for its executive official put it, "it's better to consider an organized demand, than face an unorganized mob."

Incidentally, the airline has entered total flight, on developing an cargo business, which accounted for much of the 12% of total operating revenue in 1961. Coffee, produce and hides are the main cargo items and EAL hopes eventually to increase produce shipments to the point where Ethiopia can compete with Kenya, which ships great volumes to the larger Ethiopian cities and the British port facilities of Aden on the Red Sea.

Only a few years ago it was impossible to export coffee growing wild in the two west of Jinsha, because of the lack of roads. Today, EAL runs two C-47s on a daily schedule in that area for the months out of the year. In a good year, as much as three tons of coffee a day will be transported to each airport. On the more trips, the aircraft carry passengers, along with produce and a variety of items including goat and moccasin. A typical route from Addis Ababa to Jinsha and back to the Addis Ababa airport requires about 12 hr.

Nearly 100 landing strips are on 6,000 ft high mountain tops with steep slopes cascading 1,000 ft. in length, not level by miles of rocky, pockmarked slopes. Some are equipped with radio stations and all are serviced the same manner, as slaking the tropical rain, which when heavy conditions are at their worst.

As unusual but repeat of source of income to the airline is the carriage of



BOEING 707-320B Boeing 707-320B in flight over Addis Ababa, Ethiopia. EAL has purchased two Boeing 707-320B for use on long-range routes to Europe and from Africa north from Mombasa, Nairobi, to Addis Ababa, Ethiopia.

a truly paid called "chari." Considered a mild stimulant by the Amharas, that grows wild in the interior of Ethiopia and last year earned EAL \$868,800 as for a good agreement with Aden Airways. Some of the "chari" was in Dux Dura, Djibouti and then Aden. Importation of the fuel as a source of income is indicated by the fact that its export earned one 25% in 1961 to over 3,000 tons. For the first 11 months of last year, that revenue approximated \$790,000.

Perhaps the most pressing source of future revenue will be the shipment of fuel from such points as Dux Dura to Djibouti. EAL estimated this cargo will reach 60 tons a day, and will in turn require C-47s and later converted DC-6s. Plans already being studied by several companies consider the establishment of a large, sloughy facility at Djibouti. The cost of not-increasing two within Ethiopia is about 12 cents per pound of cargo, and EAL feels it will have no problem in cutting this with one of four low-cost airlines produced faster of only 37%, an in available tonnage loss.

China Seeks Britannia's

London—Representatives of Red China last week were discussing possible purchase of some of the 14 British Comet 4s owned by Britannia Airways Ltd. Subsequent reports say the deal is still in the air (AV Oct. 16 p. 3).

One document has been given by delegation from the Chinese Ministry of Aviation, Chinese Republics Airline and the Chinese Government Purchasing Corp. They are in Great Britain in connection with Red Chinese purchases of British Viscounts (AV Oct. 16 p. 3). The 1961 p. 37, which caused a political storm in the U.S.

Informed sources say no decision has been made by either BOAC or Red China. Asking price is about \$400,000 per airplane.

On the budget books, as they would be maintained by these internal sources are not profitable. However, EAL prefers to consider them as "out of pocket" operational costs. Reducing such as direct costs in depreciation, some maintenance and system overhaul, these costs are profitable and will some day return sufficient revenue to meet all allocable costs EAL management believes.

While the airline currently serves as a banner of national prestige for Ethiopia, EAL officials are relaxed that the enterprise is "resilient" and has not made any unreasonable demands for extra expansion beyond the country's capabilities. EAL has made a thorough study of the future of commercial aviation in Africa, and finds that no further expansion can be undertaken until a measure of economic stability, some degree of political and economic stability. Many more which it considered would be unsupportable at the time, while negotiating for others is complicated by the fact that few of the countries involved have planned far enough ahead to know what this meant as the test of responsibility.

One of the major points desired by EAL, for addition to its fleet—three made near Addis Ababa, from Good—headquarters of Air Ethiopia, a subsidiary of EAL former French colonies now report any that own airlines with the support of Air France. Attempts to gain traffic rights into Addis Ababa, EAL, has been previously known, of the reluctance of Air France, which has not ordered two Douglas DC-8's but has a small order of six Boeing 707's for the country in Khartoum in Sudan.

EAL's experts have emphasized on the future, on its trans-Africa run, which now offers two DC-68 flights a week. In April next flight will be operated with a Boeing 707. The airline has no plans to visit a North African route at the time and prefer to accomplish first an international route with a negotiating route to London.

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ent of Astra, Glens, to Post and Low do.

Practicalities face and clarify, particularly on the long hauls from Europe to Africa, offer the best opportunity for future profits, the airline feels. Plans made early on the company's three DC-8B average about 52,400 per plane with the scheduled service and can be reduced to only 52 on a charter basis. Utilization of the aircraft, which considered one from Africa, seven European and two Nairobi schedules a work plan to the air delivery has been 8 hr a day.

While EAL has made admirable progress, it still must await completion of the country's airports and navigational systems. Construction of Nile International Airport is still behind schedule, even though the runways have been finished. Maintenance and overhaul facilities, which will permit work on all aircraft, will not be finished until the summer, and all work will be on the Boeing 720B is now being handled in Frankfurt to Lufthansa. Sufficient experienced staff may not be available until the end of next year.

Much of this delay was caused by economic, to train skilled construction workers on the spot, and by competition of the Ethiopian rail.

Much of the earth is an unusual type of loam, called "cotton soil," extending as deep as 12 ft. During heavy periods, this soil results like a sponge, causing structures to heave and crack. To avoid this problem, since airport building foundations were first excavated to deep in 12 ft, and then filled in with rough aggregate before concrete flooring could be poured.

Then, then, the engine overhaul shop, which was nearly complete, fell victim to this problem. The concrete floor bulged upward and had to be replaced.

Small Airport Program

Washington — Program intended to demonstrate the need of the nation's smaller airports for improved lighting, navigation and instrument approach aids has been launched by Air Transport Association.

The program is intended to counteract effects of smaller airports and their emergency facilities which are represented in-line service that could be obtained through the installation of modernized lighting, navigation and landing aids.

The program was to be presented to the Federal Aviation Agency for work with the report that this agency also placed emphasis on the development of new navigation and landing aids specifically designed for use at smaller airports. The program is represented in a small booklet entitled "Making the Most of the Small City Airport." Copies are available from ATA, 1800 Coast Ave., N.W., Washington 6, D.C.

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AIRLINE OBSERVER

✦ Eastern Air Lines has found that 17.5% of its Air Shuttle passengers have been converted from airline transportation. In an Eastern survey, 94% of the respondents to a questionnaire said they would use a route on the Washington-New York-Boston route if Air Shuttle were not available and 7.5% said they would use it in lieu. Total of 49% listed the convenience factor as the most important factor in their decision to use the Air Shuttle while only 5.0% gave price as a factor.

✦ Keesler Aircraft has received its student fare discount from 25% to 50%. Increased, eligibility requirements and made the cut rate available to more routes. The new promotional tariffs are available to all college students, including those taking evening and correspondence courses, high school students and persons enrolled at satellite or model institutes. Flights may be made on all types of equipment. The student tariff was reintroduced at the Seattle-Boston route on Jan. 1, 1962, and now appears to have a permanent place in Air Shuttle's fare structure.

✦ Robert E. Peach, president of Midwest Airlines, told the Civil Aeronautics Board that the carrier will welcome an industry reduction of the Bantam rule. He added: "But I must point out that such cut in subsidies will mean a cut in service to the degree which it must be made in the communities that require subsidized service." Peach was commenting on subsidies by CAB that it is determined to put the brake on local service airline subsidies.

✦ Air Shuttle type of operation will be expanded Mar. 1 by Eastern Air Lines to include secondary flights between New Orleans and Houston. The new service, called "Walk-On" flights, will feature no reservation, pre-announced, guaranteed seat and low cost. Chief difference between Air Shuttle and the new service is that seats will be served on Walk-On flights and the new service will be available on all Eastern's secondary flights, including jets, between the two points. No new flights will be added, but existing aircraft will be available to provide seat guarantees.

✦ Flight Engineers International Association has asked CAB to withhold approval of the transfer of Midwest Airlines' routes from its franchise to Eastern Air Lines. The union charged that Eastern never intended to reach an agreement with FIEA, but placed a ploy to eliminate the Eastern chapter of FIEA in bargaining representative for flight engineers.

✦ Rolls-Royce has quoted thrust on its Conway RC40-22 turbo engine from 17,500 lb. to 18,000 lb. Specific fuel consumption has also been reduced by 2% under all operating conditions. Altkia has ordered the increased thrust version to power two Douglas DC-8 transports.

✦ Capital of all 15 Soviet republics comprising the USSR now have scheduled jet passenger service. Latest to be added was Vladivostok, capital of L'vinskaya, when Tu-114 turboprop transport scheduled from Moscow were introduced last month.

✦ Domestic transatlantic industry reported a 3.8% gain in revenue passenger miles during December, compared with the same month last year. Coast traffic continued to grow and showed a 12.7% increase, while full-land revenue passenger miles plummeted 47%. Available seat miles climbed 11.2% to drop the load factor to 56.1%, well below the breakeven level required by a number of carriers.

✦ United Air Lines' proposed two-class service (AWF Dec. 15, p. 45) is drawing less industry opposition than anticipated. Rumors say that the United plan could start the continuing discussion of first-class traffic to coast.

✦ CAB last week granted a tentative approval to Qy Leontash, Philadelphia AD of Finland to conduct charter operations between Finland and the U.S. Because the bilateral agreement between the U.S. and Finland covers scheduled service only, the Board issued a two-class order making retrofitted parties to state reasons why a foreign air carrier permit for charter service should not be granted to Finland.

SHORTLINES

✦ Allegheny Airlines has received CAA Airline Board approval to extend by one hour its scheduled round trip New York-Boston service. The first flight, which originally departed at 7 p.m. Sunday, is now available between midnight Friday and midnight Sunday.

✦ American Airlines will install Honeywell Model 100000 Series Lights (ASL) on its Boeing 720 turboprop twin jets. ASL uses a condenser-discharge versus lamp, similar to photographic strobe units, which can be used at a range of 100 ft in daylight or 25 ft at night. Three of the lighting lights will be installed on each wing, one on the tail.

✦ British Overseas Airways Corp. will begin a twice-weekly service between London and Dallas International Airport near Washington, D.C. on Mar. 6. Service will be expanded to daily flights this summer.

✦ Canada's Air Transport Board has granted Midwest Airlines operating rights between Buffalo and Toronto. Civil Aeronautics Board president McEwen made the decision in December, 1961.

✦ Eastern Air Lines will increase its advertising budget by 51% in 1962 over 1961. Campaign will include extensive use of television for the first time.

✦ Frontier Airlines has signed a two-year contract with its 145 pilots. Basic fee was increased by an average of 4% per pilot. Agreement covers twelve two months before old contract expired.

✦ The American World Airways will show an 18% increase in passenger traffic and a 21% rise in air cargo tonnage for 1961, compared with 1960.

✦ Trans-Texas Airways carried 369,240 passengers during 1962, a 20.1% increase over the previous high year of 1961, when it carried 321,617.

✦ United Air Lines has been granted three overland time extensions by Federal Aviation Agency on its fleet of Vietnam Warzone turboprop transports offshore from 4,350 to 4,500 lb. payload from 5,300 to 5,150 lb. and takes cooling turbines from 6,420 to 7,200 lb. Time between enroute on the Kolls-Bowen Dart turboprop engines is 1,500 lb.

✦ Western Air Lines has purchased three more Boeing 720R turboprop transports at \$5.5 million each, bringing its 720R fleet to 10.

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Based on the 100 thrust turbofans on the engine power units for the V/STOL applications, because the total thrust can be used for both lift and forward propulsion. This permits the simplification of a single engine installation in which each separate lift engine, that provides a simple and more economical solution than can be achieved with any combination of separate lifting and propulsion engines.

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- ✦ Simplified installation.
- ✦ Simplified aircraft control.
- ✦ The resultant thrust and attitude drag

passes through a fixed point near the tip of each engine's propeller.

- ✦ Simple power and space requirements are contained in one engine.
- ✦ Availability of a large point of reference for installation and maintenance.

MULTI-ENGINE INSTALLATION

- ✦ To cover operation of lift engines required as the total propulsion system reaches a critical take-off.

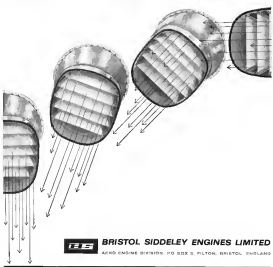
UNIMPROVED FLIGHT

Based on the 100 thrust turbofans that can be burned on the lift power during air phase, a thrust engine is given a thrust boost for

take-off and improved flight. This plan is considered for use in:

- ✦ A large thrust boost for improved speed with such a small increase in speed for maximum plan.
- ✦ Engine performance matched to aircraft engine requirements.
- ✦ Greater thrust for increased acceleration.
- ✦ Greater radius of operation.

These thrust boost advantages are subject of many improvements in the development of the United States Government through the Special Weapons Development Program.



[illegible][illegible]

By George Alexander

Houston, Tex.—Scientific experiments planned for the ninth Mission to Earth-orbit, scheduled for April 2—reflect increasing emphasis on the Manned Spacecraft Center's role in the collection of experimental data for the development of rendezvous techniques.

The center presently is planning on a minimum of 35 orbits for Mission After 9 (MAG-9), with a decision to be made at that time on continuation of the flight up to 22 orbits (MAG-22).

Joint management of the MIA-9 space-mat—specifically, the efficient utilization of all on-board resources—is the primary task of the mission assigned to USAF Maj. Cordell Cooper. But the requirements are expected to provide data useful in the Gemini and Apollo programs. Experiments include:

• Zero-g propulsion flow: A 4-ft square, 1-in. thick, filled with two pounds of hydrogen peroxide fuel, will be mounted on the airbrake package located on the canopy's rear shield. The fuel

packaged in 450 psi. be. gaskets are gaskets will be fitted with two small sensors. May Cooper will be able to find these by flipping a single switch on his instrument panel. Purpose of this experiment, which is similar to the capillary tube and flask carried aboard MVA-1 (AW No. 28, p. 26) is to determine flow characteristics of a fluid under zero-gravity conditions. Amount of angular disturbance caused by firing of these small thrusters will indicate amount of attachment flow.

② Flashlight, light aperture, A 5-m-dia. 2.5-l-sphere containing a high-intensity-light and batteries, will be mounted on the spacecraft. Once in orbit, it will be maneuvered at an angle of about 92 deg from the flight path of the capsule and the two spacecraft separated. The capsule and the sphere, separated to 300 m apart, thus operate like a small artificial vorticity and remain within viewing distance of the MAIA spacecraft for almost three orbits. Light will be programmed to flash every 0.05 s; second, and Cooper will attempt to photograph it with a hand-held 16-mm movie camera. The close orbit will ensure distances between the capsule and the flashlight are the same correlation with the sphere.

8 **Atmospheric drag.** In a report of an experiment flown aboard MA 7, a 50-m-dia. *Mikoladomomy* sphere will be towed behind the orbiting Mercury spacecraft on the end of a 100-ft. line to measure atmospheric drag at these altitudes. Primary purpose of this balloon experiment will be to determine drag characteristics of the atmosphere.

tioned orange sphere (the sphere on MA7 was not color-coded) is considered to be of secondary importance. Manual Spacelab Center program officials see these as useful correlations between the stress gauges, which linked the balloons to the MA7 capsule, and the gaseous accelerometer during testing of Scott Carpenter's MA7 capsule. Some of the MA9 balloons have been worn tighter to provide gas pressure—believed to be the across the MA9 balloons failed to expand correctly.

There will be one biomedical experiment and some minor changes in instrumentation. In the biomedical experiment, Cnopus—who is expected to spend between 27 and 34 hr. in space—will urinate periodically, into a special container. Using a combination of sponges and gauze, he will collect and transfer some samples into a small plastic bottle, with the time of urinations noted precisely on the bottle.

After the fight, urushiol will be associated with the digestion of periods of wakefulness, to see if prolonged waking leads to any back chemical reactions.

exchanger system. Cooler programs on gaseous, saturated with the liquid data on light boxes of Gorman and Apollo, would like to make maximum use of everything aboard a spacecraft and want to determine if some—others in a wave, unless constructed in portable water—can be used as a coolant fluid for the cabin.

Cooper says that down the other cooling system completely, for short-

periods of time during his flight if the temperature within the cabin stabilizes at an acceptable level. Soil contact is not new, however, will occur continuously.

Rental thermocouples, which have been used on all previous Mercury flights, will be replaced by an end way. The new thermometer will be attached to one of Cooper's corbioners made his helmet and will be hinged so that it can be swung out of the way when not in his mouth. When not in use to measure the pilot's body temperature, the thermometer will be used to monitor suit and/or temperature. The new instrument unit is located in the helmet.

Cougar will wear the same type of radiation detection patches on his body as preceding Marsman pilots. In addition, a patch may be placed on the inside of the cosmonaut's access hatch.

Flitch-patch estimates data would be combined with that gathered by two low-energy level, non-directional station detectors mounted on the MIA-9 here should Radiation attention through the Mercury capsule window spacecraft is unknown. It is not believed to be severe, but center project direction want to know, for certain.

It is hoped that Cooper will be able to sleep during his long-distance flight. Biomechanics specialists here would like to use Cooper's eight-hour sleep period divided. Sleep period presently

thinning. Two- or nylon tie-backs may replace the frame and attachment hardware much of either situation in the forthcoming Vespene Alloy-8 Night of USAF Maj. Gailine Cooper.

The new couch consists of padding-on nylon strands about 1/16 in. (7/32 in. dia.) thick, and a long, high-density nylon or polyester mesh, depending on the big between deflation and return to original dimensions at no charge material. The strands expand roughly 80% and do not contract to original length when loads are removed. Although some have a given oil, it is not a heat reaction which causes deflation of the strands.

Strands of the couch are deflationally preloaded to compensate for the relative weight of the pilot's body members resting on their section. Two sections, for example, have a higher pre-load strength than the head area. The loads are calculated to accommodate both the pilot's weight and the g forces of boost flight. The strands contract slightly in the pilot's fully reclined, but do not deflate to their maximum load under this approximate 1-g load.

At altitude, however, when loads imposed upon the pilot approach 16 to 12g, pre-load tension is cancelled and the nylon gives. Because the strands are loaded differentially, some strands give first, then others and so the pilot's body continues to expand.

Nylon strands are made by Stroh, Inc., of Lincoln, R. I.

If the couch is used as M&M, Maj. Cooper also will wear a new, smaller harness, designed for the 180-pound pilot. The harness will be 100% nylon, like the one that automatically struts in the pilot, under recovery loads, into deeper into his couch. There is no release on the legs so that the pilot remains held tightly against the couch.



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Rocket Cluster Firing

Quadruple cluster of four strap-on, solid-propellant rocket motors producing about 140,000 lb. of thrust was recently test fired successfully by United Technology Corp., a division of United Aircraft Corp. (AW Jan. 14, p. 31)

planned for the flight is broken up into two four-hour periods. Opportunities at completion of work-rest cycles, three control personnel feel, would be 5 to 10 hr of duty, 4 hr sleep or rest, 5 to 10 hr of duty, and then four more hours of sleep or rest. Final 6 to 10 hr remaining in the flight would be spent awake and on duty.

Procedures are being made to provide the pilot, if necessary, through a two signal sent to the capsule's command system. It would be transmitted by whatever ground tracking station has the capsule within range at the time.

Present planning calls for letting the sleeping pilot sit in his two-drift capsule, pass through orbit transitions without resorting to the spacecraft to a sleeping attitude in order to maintain a track control that during the drift flight of Walter Schuett's MA-5 capsule, the spacecraft was re-oriented to retro attitude at the end of each orbit in the event a decision was made to terminate the flight at that point.

Waking up the sleep period into two almost equal segments would provide more useful data, it is felt, than that which can be gathered during one nighttime stretch. First sleep period would yield baseline data against which the recovery at the second sleep period could be compared and evaluated.

Not all on-duty hours will be spent

in continuous work, there will be breaks where Cooper will be allowed to do as he chooses—take photographs, make use of ground simulators, etc.

Probes of Cooper's metabolic, respiratory and blood pressure readings will be extremely important to bioastronautics research. Data on these cycles—how long, plateau and post-plateau—will make a major contribution to the detailed design of future life-support systems. It is anticipated that oxygen consumption will increase linearly with flight duration, but that food consumption and water intake flow rates will vary with work requirements.

Several other experiments are planned on the MA-5 capsule itself. These will be at least one- and perhaps two-where probes of crew fatigue (just a panel) applied to an approximately 6 or 6.5-square inch on the ground altitudinal section of the capsule.

Thermocouples attached to the inside of the structure behind the patch will indicate variations in heat transfer through the coating during ascent, orbital flight and reentry.

In addition, one or two of the strapping devices will be polished to a high mirror finish for determination of micro-accidental impairment during orbital flight. These changes will be examined after the flight and recovery of the capsule for detection of micro-accidental injury.

Experiments have to be made to discriminate between true micro-accidental strikes and fast particles encountered either during ascent or reentry.

Four pounds of breathing oxygen will be added to the MA-5 capsule. A 15-lb capacity, independent reserve tank has been added to the attitude control fuel system (AW Oct. 8, p. 25), but will contain only 10 lb of hydrogen peroxide. Two 1,000-watt/hr batteries will replace the two 1,000-watt/hr power supplies used on earlier Mercury flights.

New pounds of water will be added to the spacecraft cooling system and six pounds of water to the pilot's drinking supply. Lifespan breadbox, built-in-baking oven, has been increased from 6.5 lb to 1.6 lb. Food will be dehydrated and combined with water before eating. Legumes, such as orange juice and cocoa, will be powdered and reconstituted by the addition of water.

As on previous Mercury orbital flights, Cooper will attempt to make sightings of stars ignored on the ground. Perth, Australia, and Dorben, South Africa, have been used on earlier flights, but cloud cover proved an obstacle that the National Aeronautics and Space Administration is considering several other areas. Cooper also will carry a photoaster to measure the atmosphere. Speed of the capsule type recorder,



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- ENERGY MANAGEMENT SYSTEMS
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used to store pilot communications when his spacecraft is beyond range of a ground station, will be cut in half, from 15 to 10 ft or less, to match the capability of the tape recorder without increasing tape length. At its present speed, the recorder has an 11 ft capacity.

Reducing the speed by half increases this to 22 ft.

Slow scan television system will be installed rather than the capsule above and to the left of the instrument panel, and leaving the pilot. The television camera will take one single lens adapter so that it can be rotated to look out the pilot's window.

Copper will carry a 16-mm mirror camera, built by McDonnell-Herritt Corp., which also manufactures the Mercury and Gemini spacecraft, in addition to the hand-held 15-mm camera and for stereographic photography in earlier Mercury flights.

The 16-mm camera will be mounted in a removable, self-contained module in the instrument panel.

Installed in the panel, the camera will monitor the pilot and his motions in various images. But it can be removed and placed on the instrument panel or hung on a rack over the capsule's window to film the performance of the dry hulk.

Camera port can be set by the pilot

either at six frames per second or a single frame per second.

Camera, with three rapidly interchangeable lenses—wide angle, telephoto and normal—will be equipped with an image intensifier, each with 100 ft of film.

One of these ports will contain a forward film. Cooper will shoot this roll for the Massachusetts Institute of Technology, in support of its program to obtain a better definition of the earth's horizon as viewed from space.

This data is considered vital to the Apollo guidance system, which MIT is developing.

Lockheed Develops 'Radiation Yardstick'

"Radiation yardstick"—which will provide exposure with a definite guide for designing structures and for shielding nuclear reactors—has been developed by scientists at Lockheed Martin and Space Co.

Technique measures the fast neutron absorption cross section in gold, which is used as a standard reference in determining the absorption characteristics of other materials. The exact port embodies a spherical shell of thin gold



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2 in. in diameter, which contains a neutron source material. Shell is surrounded with alpha particles from a Van de Graaf accelerator, all the neutrons thus produced are then absorbed by the gold as pass through the gold.

The precise dimensions of the reflectors, produced by the neutron source and that created in the gold by the absorbed neutrons is an indicator of the neutron absorption characteristics of the gold.

Prime goal of the technique was to develop a standard for neutron absorption in the energy range from 10,000 to 400,000 electron volts, which has been a source of disagreement among nuclear scientists.

Cameras to Monitor Entries of Meteors

Washington—Satelliteborne photographic film covering seven Midwestern states will go into operation soon to monitor meteor entries and to locate meteorites after they have fallen on the earth.

The project called the Prairie Network, is managed by the Smithsonian Astrophysical Observatory under a \$140,000 grant from the National Aeronautics and Space Administration.

Objective of the photo program is to photograph bright meteors as they enter the earth's atmosphere, and to locate by triangulation the precise points where they land.

When the system is fully operational it will automatically photograph the sky in all directions from Illinois to Iowa.

Photodetecting system will sense darkness at each station and activate the electric power to operate cameras. Aerobics scans will not see Polaris, the North Star.

If the star is obscured by cloud cover, the station will shut down.

Each station will have four cameras with 19.5 lenses covering 80 deg. view angle fields.

Scientists will study the chemical and organic structure of recovered meteorites. Photographic data will provide size information on brightness, velocities and orbital elements of meteors.

Film plates used in the Prairie Network program will be 9 in. square. The plates will have exposure times of up to 2 hr.

Paul Saganian, Charles Tegen will have his headquarters in Lincoln, Neb. Stations will be located in Illinois, DE, Idaho and Ohio, N.J., Virginia and Carroll, Iowa, Minnesota, Missouri, Alaska and North, N.Y., Elizabeth and Rehoboth, S.D., Massachusetts, California City and Placerville, Calif., and Woodward and Hancock, Okla.

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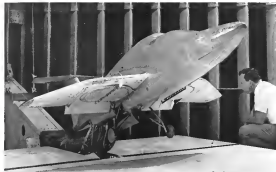
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ONE-SIXTH SCALE MODEL of XV-5A with dynamically similar flow is shown during test runs in wind tunnel. Wind-tunnel air speed is shown through flow lines; flow-tube tubes indicate a smooth laminar flow.

Flight Tests of XV-5A Scheduled to Start



ONE-SIXTH SCALE MODEL of the lift-in-flight aircraft vehicle installed for testing in the presence of simulated ground in General Dynamics/Convair low speed wind tunnel. Airplane is in third attitude typical of conventional landing. Wing flaps are deflected full down.



MODEL of XV-5A showed fuselage and engine inlet screens, built to aerodynamic scale, was tested at angles of attack and yaw over a speed range from 10 to 100 mph. Tests were made in the Convair wind tunnel and Navy's David Taylor Model Basin.

This Summer

By Elwood A. Anderson

See Design—Structural design of the XV-5A lift-in-flight aircraft vehicle is scheduled to be completed at the end of this month by Ryan Aeronautical Co. engineers.

First of the two VTOL aircraft now under construction here is expected to start its flight test program July 17.

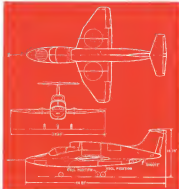
Between now and then, the engineers will be working against a tight schedule with three milestones marked as goals:

- Feb. 1: Completion of five-degree conventional flight simulation.
- Mar. 1: Completion of all engineering systems design in shop, first fuselage out of the jig.
- May 1: Completion of an eight-degree lowering simulation.
- Apr. 1: Start of aircraft static test.
- May 1: Completion of hydraulic system simulation.

Second aircraft is scheduled to be delivered to National Aeronautics and Space Administration's Ames Research Center for full-scale tests in the 40 x 80 ft wind tunnel starting early in July and extending through mid-August.

First hovering flight of the first aircraft is expected to be made Aug. 1.

Currently, all model wind-tunnel testing is essentially complete with the exception of flutter work, which is



XV-5A THREE-VIEW shows current geometry of the Ryan-designed and-built six lift-in-flight aircraft. Ryan is subcontractor to General Electric.

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[illegible]

scheduled for early completion. The automatic stabilization system for the XV-6A has been completely fabricated and qualified. Three degree longitudinal translation of hovering and transition also has been completed.

XY 5A (formerly YZ-11) is a light-research vehicle for the General Electric K3333 lift fan system which handles both propulsion and lift for the aircraft. Because of this dual function of the lift fan, integration of the aircraft and engine assumes proportions larger than ever before in any type of aircraft design. One General Electric engineer pointed out that it used to be bad enough when the engine company tried to tell the airplane people how to design their structure; now, he said, engine firms are trying to interfere with their customers as well.

This close integration of software and engine is the main reason that General Electric an engine company, is the prime contractor on the aircraft. Ford Aero is a subcontractor to GE under a contract with Aero's Transportation Research Command (Thrust).

Other major contributors to the program include NASA, which is the program leader; NASA, which has already paid for the development of the detector system; and the University of California, which will furnish the P-3 aircraft and the ground support system for the flight.

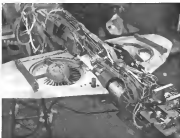
Direction: South

Lightweight optics units are being developed specifically for the XV 55 by North American Aviation's Columbus Division. Aim is to get a net weight of 500 lb. The crew member through the scope at any flight speed from 500 to 450 ft. forward.

FAA's aviation agencies will meet in Annapolis to discuss GE and Boeing during the development program and finally settle an opinion on whether or not the airplane could be flown by a single Army pilot. FAA will give, on its part, experience in the routine development of a complex VEH aircraft, which the agency will be able to add to its knowledge gained on other projects.

Value of the contract contract between GE and Timcon is \$10.5 million, of which a little more than half is scheduled to go in fees for development of the contract.

XV-5A is a low-wing airplane with a high-mounted T-tail, and engine nacelles on top of the fuselage aft of the cockpit. Its wingspan is 29.83 ft., overall length is 44.52 ft., and its maximum height is 18.73 ft. Design gross weight is 9,700 lb., with a landing weight for VTOL operations of 12,000 lb. Overload fuel for ferry flights over the maximum allowable gross weight up to 13,000 lb., and maximum conventional



INTERNAL CONSTRUCTION of the complete scale model of the GE/Ryan XV-1A is shown in photograph of the incomplete model. Wing ribs are dyewoods, smaller, but analogous of the structure is conventional wind tunnel model.

Training and takeoff procedures

Under the terms of the contract, two aircraft will be flown by Ryan through a 10-hr demonstration before delivery to the Army.

Joint Army-Navy testing will follow the initial flight demonstrations, and finally the Army will take over completely for a research evaluation lasting approximately three months.

Those ideas leading to the development of the lifting fan system were developed independently by GE's Peter Koppes and Alza's John Peterson during the mid-1950s. Both men have applied for patents. Hearings on possible interference between the applications are still pending in the U.S. Patent Office.

Specific lift line system to be installed on the XV-5A arranged as the recommended optimum system for VTOL operations from a two-phase study, conducted between GE and Lockheed during 1957 and 1958. At about the same time, Ryan was working under an Air

In 1999, Army awarded C&E a further contract for development and construction

This test series examined the isolated use of

than 140 hr of running time on full-scale hardware, with a substantial portion of that time logged in the AWS cloud (see table).

After specifying a pair of performance objectives for the vehicle, asked for a guaranteed copy weight of the wheels, and delineated other design objectives, such as vehicle body system.

Performance Goals

Performance objectives were tailored both sides around the same flight profile, acquiring a four-minute hover at the start, a light cruise at best endurance for a specified period of time, and a 10% fuel reserve at the end of the mission. The two sets of objects or difficulties in the lift-weight ratios specified. First of these criteria for a lift-weight ratio of 1.2, and 30 min. flight time at best endurance. Second required a lift-weight ratio of 1.85, and 45 min. flight time at best endurance.

Participants specified that the lift/wright ratio was to be based on available lift without considering the control power required.

When dispatch took a conventional approach to their proposal. They made geometric studies of the kind of airframe that might be required to do the job, and investigated the possibility of converting or rebuilding existing aircraft to one cost and two.

But they concluded from these studies that neither cost nor type would be used, and that probably the cost of

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PERIOD	0.1 years to 10 ¹⁰ sec	0.1 years to 10 ¹⁰ sec
PRICE, F.O.B. FACTORY WITH IN-LINE READOUT (option N1)	\$2,500	\$2,300
	\$2,750	\$2,500



Model 727B Interval Counter-Timer with 1000 Hz input range

DC to 13 mc

Model 727B

The Model 727B provides 30% greater frequency range at prices directly competitive with vacuum tube units.

Model	1000 Interval Counter-Timer	1000 Frequency Pulse Model	1000 Time Interval Model
FREQUENCY	dc to 13 Mc	dc to 13 Mc	none
TIME INTERVAL	0.3 years to 10 ¹⁰ sec	none	0.3 years to 10 ¹⁰ sec
PERIOD	0.3 years to 10 ¹⁰ sec	0.3 years to 10 ¹⁰ sec	none
PRICE, F.O.B. FACTORY WITH IN-LINE READOUT (option N1)	\$1,395	\$1,375	\$1,580
	\$2,110	\$2,000	\$1,755



Model 726B Interval Counter-Timer with 1000 Hz input range

DC to 5 mc

Model 726B

The 726B provides a 5 mc frequency coverage at 1 mc prices.

Model	1000 Interval Counter-Timer	1000 Frequency Pulse Model	1000 Time Interval Model
FREQUENCY	dc to 5 Mc	dc to 5 Mc	none
TIME INTERVAL	1.0 years to 10 ¹⁰ sec	none	1.0 years to 10 ¹⁰ sec
PERIOD	1.0 years to 10 ¹⁰ sec	1.0 years to 10 ¹⁰ sec	none
PRICE, F.O.B. FACTORY WITH IN-LINE READOUT (option N1)	\$1,350	\$1,350	\$1,325
	\$1,700	\$1,590	\$1,475



Model 724B Frequency Meter

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FREQUENCY	1 cps to 1 Mc	1 cps to 1 Mc
PERIOD	10 years to 10 ¹⁰ sec	none
PRICE, F.O.B. FACTORY WITH IN-LINE READOUT	\$1,300	\$975
	\$1,225	\$975



Model 733C Frequency Meter with 1000 Hz input range

DC to 1000 mc

Model 733C

The Model 733C frequency meter consists of an all solid state 13 mc frequency divider and a precision vacuum tube test equipment converter. Model 733B extends the digital range to 300 mc. Model 733C covers the 200-200 mc range. Model 733B covers the 200 to 200 mc range and Model 733C covers the 200 to 1000 mc range.

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Price: Model 733C (less plug ins) \$2,350 with vacuum test set \$2,475. Plug ins: Model 733B \$250 Model 733C \$300 Model 733B \$475 Model 733C \$500

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CMC WHERE QUALITY COUNTS

37



on target with MCR—the Military Compact Reactor being developed by Allison for the Atomic Energy Commission. Lightweight and extremely mobile, it will generate 3000 kw of electricity. The AEC selected Allison as prime contractor "on the basis of company capability to carry out the entire project." That kind of capability is also working in a creative environment on advanced turbo prop and turbo shaft engines, Winsteman rocket cases and many other aerospace and nuclear projects, all of which are on target.

Allison
THE ENERGY CONVERSION DIVISION OF
GENERAL MOTORS CORPORATION

choked at the wing, followed the leading moment of inertia. Practically even angle degree between the air plane shown in one way or another from the use and shape of the two wings.

XV-5A lift fan is rated at 7,430 lb. of lift thrust or 2,580 lb. of horizontal thrust, depending on the operating condition. Section weight is 1,345 lb., which corresponds to a thrust lift/weight ratio of about 9.4 for VTOL flight.

Heart of the section is a General Electric J85-GE-5 gas generator, surrounded in either hardware or controls. Interchangeable dimensions of the gas generator section is a 10-inch valve, which forms a T in the flow line. The diverter can be operated to allow the discharge of the gas generator to flow straight through and not acting as a simple air intake or to flow through 90 deg. into a turbine scroll, and drive—through representative angle-stage turbine—a large diverter, angle-stage engine fan (AW Aug. 3, 1960, p. 94).

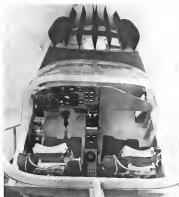
One fan to visualize the lift fan component is to think of a stack of sub-cylinders. The top cylinder is an assembly of inlet louvers in a large bellmouth to direct the air into the engine fan. The second cylinder is the fan assembly and the turbine scroll. Third cylinder in the stack is the diverter, the fan stator and the turbine stator assembly to direct the air leaving the fan.

In VTOL operation, all the air going through the fan is directed downward to produce vertical thrust. For forward motion, the roll thrust is gradually tilted to diffuse the air into the forward flow. When the aircraft is moving fast enough to be supported on wing lift, the diverter valve is closed to give all the air through the jet engine scroll, for forward thrust and the fan inlet and exit are closed.

Step-thrust velocity below the fan is about 300 ft. per sec. The GE's condenser turbine at forward lift, shows that the step-thrust, into the ground, and speeds not actually, starting very close to the surface of the earth. One engine described waiting under a very thin to walking, operation on a very shallow, last flowing back.

Engine engine start to full speed operation of the gas generator takes between 10 and 15 sec. The fan develops 100% lift about three to four seconds after the diverter valve is closed to feed the fan.

Turboprop Mach number at takeoff conditions of 2,040 ft. per sec. is as the wing of Mach 1.5 to 0.65. The fan handles about 195 ft. of air per second. Installation in the XV-5A orb for a pair of these fans connected with



COCKPIT OF XV-5A cockpit shows combination of conventional and helicopter control features. Pilot has from the left seat with the right seat is a 100 ft. instrument package specified in aircraft configuration.

interchangeable engines or ducting for single-engine action. In the event of a single engine failure, the remaining engine is the correct response in forward or gas turbine engine between the two fans through the crossover ducting. Because of the complexities of the fans, and their dimensions of operation, each fan then produces about 60% of its design lift, although being close with only half its design power. This means that 60% lift is available as single-engine operation, and the XV-5A will be able to land out of a VTOL approach on a single engine if it is slightly loaded.

An essential part of the fan installation in the XV-5A is the main prop fan, driven by a pair of ducts leading from the main gas generator supply. It not only produces about 900 ft. of lift, but in many and out can be opened and controlled to produce any value from about 1,000 ft. to near-up thrust to about 200 ft. air-flow.

Basic reasons for the wing design was that it had to accept the fan, and yet be the smallest wing possible so as to attain the highest possible wing loading. Wind tunnel tests showed an optimum distance between the leading

edge of a wing containing a fan, and the distance to the fan bellmouth. It was this test that determined the leading edge location of the XV-5A wing.

Wing designers worked a straight upper surface in the wing structure, so they chose to locate it directly aft of the fan, as close to the rear of the fan as possible. The fan also was to be located behind the fan with its roots at the rear of the bellmouth diameter.

Flow, which is used for ingestion in the forward mode of operation, is very effective in conventional flight, as four engines. In fact, it was so effective that it was producing about 10 deg. of downwash angle and lift is moving the tail to the top of the fan in order to get it out of the downwash and vice versa right.

Top chord of the wing was determined by consideration of the roll and, thus, the remaining available space on the wing, used the entire chord.

Analysis of the aerodynamics of the aircraft showed there would be a need for an degree of negative dihedral to eliminate the large amount of roll due to yaw. Wind-tunnel tests of wing alone and body alone showed that the motion was right, but the combination



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and near the protected center of the expanded screen. Controls in the receiver window are for the pilot only (also place in use for observed and remote collective for left control, stick for pitch and roll, rudder for yaw, and throttle for forward speed control). Modulators in the receiver will have the discrete used in conjunction with the collective, as prepared for the XV-1A (AW Aug 25, p. 31).

Pilot sees terrain features advance or decrease in size to indicate altitude. Terrain moves downward off the screen, increasing in size as it apparently passes under the nose of the aircraft to indicate forward movement. The horizon appears as a dividing line between blue sky and brown terrain and indicates aircraft attitude readily.

Simulator Realism

Realism of the simulator is enhanced by the 720-deg-angle screen, which provides continuous display to pilot's peripheral vision. More realism is provided by using the other sides of various windows located on the ground that passing by them. Pilots and engineers using the simulator actually have experienced strange and curious odors through the cockpit window displays.

Four-light source projector, manufactured by The de Flores Co., Inc., Englewood Cliffs, N. J., was purchased by Ryan complete with three different simulators. These are designed to show the following XV-1A scenarios may be simulated:

- **Transition to forward flight** from hover after takeoff. Maneuvering into a 10 sq mi. and altitude range from 0-600 ft.
- **Hover after takeoff.** Area included is over 1,000 sq ft. and altitude range from 0-100 ft.
- **Conventional flight.** Presentation includes a 45-sq. mi. area and altitude range from 0-75,000 ft.

Projector unit weighs about 3,000 lb. and is driven by an electric hydraulic pump system providing six digital air pressure—pitch, yaw, roll, and translation along all three axes. The beam from the point-light source, a mercury vapor lamp, is refracted to 0.25 in. at an arc and magnified to give a virtual arc of 304 in. Low-power intensity of the light is 15-20 foot candles along the optical axis of the collimated beam.

Point-light source mechanism which is free to move in any direction, will divide the 1,200 to 3 acre-model structure placed in the transparency of the pilot into three. The light source is prevented from moving past the edge of the 6-ft-sq boundary of the transparency when a linkage connects the boundary walls and lifts its movement.

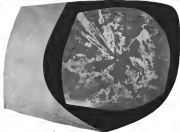
Ryan refers to the simulator as a

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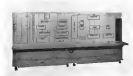


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closed loop type, which integrates the pilot, extra hardware to be evaluated, computers, dynamic terrain projection, and instrument panel. Ryan's analog computer laboratory is capable of providing for the simulator system as many as 120 amplifiers at modest cost. 100 of these elements are reserved for other company projects. Company engineers estimate, however, that for other simulator applications, such as basic handling or emergency, all 510 amplifiers might be used.

The simulator is installed in a 6,000 sq. ft. building located at the Ryan Flight Simulation Laboratory. The building is designed with large access doors to permit entrance of test aircraft, which can be tied into the loop with the pilot sitting in the cockpit of the plane to simulate flight conditions. The building also houses for testing and recording equipment, a hydraulic electronics and a telemetry laboratory.

Other applications of the simulator include plans to use it for certain phases of the X-15 flight program. The X-15, XC-142, transducer through transparent displacement program (AV Jan 14, p. 40). Realistic of the XC-142 simulator work will be done with Chaco's X-15 simulator.

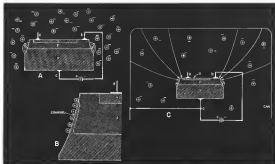
At least one large aircraft manufacturer on the West Coast also plans to use the simulator, according to Ryan.



X-15 Window

Find sites window for X-15 aircraft has for the first time transmitters tied into its outer surface. Window, 29 in. in dia., with 18 in. thick wall is mounted at the cockpit in the bottom of the ship. This has led from the observation around the edge of the glass to view outside for contact to look at monitoring instruments. The arrangement is second best distribution from the small amount of light of the X-15. Window for the aircraft was manufactured by Claring Glass Works.

AVIONICS



NEWLY DISCOVERED DEGRADATION of transistor in space isolation due to surface effects is believed to result from interaction of air or gas to produce positive ions and electrons (A). When reverse bias is applied to transistor, it produces electric field between base and collector which attracts ions and builds up channel that allows greatly increased current to flow (B). This effect is enhanced by electric field which exists between emitter and collector as shown in (C).

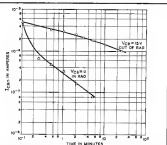
Transistors Face New Radiation Hazard

By Philip J. Kline

Important new data on surface-effect degradation of transistor produced by radiation, which caused the total blackout of the Telstar I communications satellite and which now explains the early demise of many spacecraft payloads, has been obtained by Bell Telephone Laboratories researchers. The information has significant implications for all engineers designing spacecraft systems components.

While it has long been known that high-energy radiation particles could cause non-reversible defects in semiconductor devices, only recently has it been discovered that an entirely different type of degradation results from ionization of air or gas within a transistor or diode one which exposed for some time to comparatively low-energy electrons. The phenomenon is credited to G. L. Vetter of Battelle's National Laboratory and Walter M. Gibson of ARL, while doing a surface physics experiment.


Silicon transistors used in digital circuits, such as those for command and telemetry functions in spacecraft, are far more vulnerable to the ionization effect.



PORTUGAL'S CHARACTERISTIC of surface effect radiation damage is that performance recovery occurs cyclic rapidly in the continued process of reduction of the reverse bias voltage is restored. This fact made it possible to convert Telstar satellite malfunction by disconnecting all electric power.

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complete successes in 44 test flights. Bulbup—the rocket's only supersonic air-to-surface missile, so reliable it is banded like a round of ammunition without pre-flight checkout. Lucrose—with pinpoint accuracy. All three are duty with Army, Navy, or Air Force.

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Now! The AMP-In-cort DUO-TYPE Leaf Connector... so adaption of effects actually utilized application possibilities. Individually housed contacts are mounted into aluminum plates which can be designed to meet any size or configuration requirement. Makes no difference whether you need 10, 20, 40, 100, . . . 1,000 or more positions in sensitive construction connectors. Any way you adapt it, the AMP-In-cort DUO-TYPE Leaf Connector will be right at home. To make doubly sure that it's right for you, the AMP-In-cort DUO-TYPE Leaf Connector uses special AMP's crimp type, and pin contacts. These contacts, uniquely designed to meet the stringent application requirements in these same materials, provide unobstructed electrical contact. The unique shape of the female contact creates pressure spring riding with the flat male into (G31 x G32) . . . provides enlarged contact area of contact . . . and insures greatly increased wiping action for maximum conductivity. And these are but a few of the advantages. Check these additional AMP-In-cort DUO-TYPE Leaf Connector features.

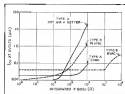
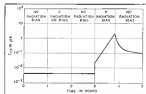
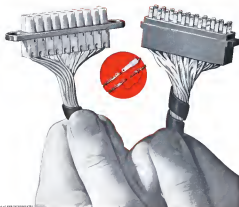
- Precision-engineered contacts applied by AMP's automatic crimping machines on a 100% bond basis guarantee the most reliable connections possible with the lowest applied cost in the industry.
- Rugged shock-resistant polymer housings provide high dielectric strength.
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- Contacts are double plated.
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- Contacts bond instantly, easily removed and reinserted. See how the AMP-In-cort

DUO-TYPE Leaf Connector can be at home in your design plans. Send for more information.

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AMP stands for a growing number of quality products including connectors in America's Defense, Space, Industrial, and High-Speed Computing.

up for adaption



INTERFACE EFFECT DEGRADATION (left) occurs only when both isolation and reverse bias are applied to results of tests on a different silicon transistor does. When isolation is removed, device shows partial recovery of original performance. Data rate was 500,000 bits per sec. Tests on left type of silicon transistor (right) show that such a loss can never be recovered as less vulnerable to surface-effect interface damage, but that some corrosion damage does occur at high total doses.

while surface corrosion degradation due to crystal structure, is not inherently permanent. Removal of the silicon device, however, from the radiation, or removal of its bias voltage results in its last partial recovery of its original characteristics.

But a most interesting finding is that recovery takes place faster when reverse bias is removed and the transistor is still exposed to the radiation which produced the initial damage. This was demonstrated in a test using two identical transistors whose collector reverse current which exposed to radiation and operation with 15-v reverse bias, had recovered to about 5 microamps. In the test, one of the two transistors was left in the radiation field with no bias voltage while the other remained on bias but was removed from the radiation.

By one event of the transistor still exposed to radiation but without any bias voltage dropped to 0.1 microamp.

In fact, another while the other transistor was removed from the radiation, the collector current dropped to 0.1 microamp.

One reason for the problem is to provide increased shielding, where partial single tests are not critical. The silicon device is protected by the equivalent of 8.53 E. O. of aluminum, designed to protect against the natural Van Allen radiation. Extensive screening tests also were used to select transistors which were relatively unaffected by isolation including the recently discovered corrosion degradation. But BTL could not regenerate the 180-fold increase in isolation level that would result from the July 8 Project Stanford high-altitude nuclear test, which occurred the day before Telstar was placed in orbit.

TRANSISTOR degradation on the basis of measured surface current flow due to radiation produced surface effects increases with the magnitude of collector bias voltage.

degraded but no radiation) required 25 times as much 1 microampere or more to bring with far less recovery.

Bell System Technical Journal article does not discuss the implications of this finding in terms of spacecraft use. It is common belief that latent spacecraft digital circuitry might be designed to test itself in self-healing by automatically decreasing its collector bias voltage at periodic intervals when the payload is not in use, at least until more permanent forces can be detected.

This is the technique employed by BTL scientists to control the radiation loss in Telstar which required three surface-effect degradation of a transistor in the satellite's command decoder. Using a specially shaped pulse to bypass the fault transistor, Telstar's functions were recovered. When the satellite went into the earth's shadow, solar cell power also was cut off and this removed reverse bias from decoder transistors, allowing self-healing to occur. After a few such incidents, the decoder returned to normal operation (AW Jan 14, p. 32).

However, BTL scientists say that full recovery can not be expected and that the original damage surface: the transistor is susceptible to a repetition of the same fault.

One reason for the problem is to provide increased shielding, where partial single tests are not critical. The silicon device is protected by the equivalent of 8.53 E. O. of aluminum, designed to protect against the natural Van Allen radiation. Extensive screening tests also were used to select transistors which were relatively unaffected by isolation including the recently discovered corrosion degradation. But BTL could not regenerate the 180-fold increase in isolation level that would result from the July 8 Project Stanford high-altitude nuclear test, which occurred the day before Telstar was placed in orbit.

While increased shielding can provide immediate relief, an can efforts by atomic equipment designed to operate transient at lower reverse bias levels, isolation as a result of damage by semiconductor manufacturers.

But this involves semiconductor crystal surface phenomena which, in contrast to bulk semiconductor effects, can vary greatly and are not generally even poorly characterized, according to BTL scientists. "Surface effects on semiconductor devices has as thus means history of reliability and performance."

Previous known basic isolation effects, as distinguished from newly discovered surface effects, are of two types. • **Photoelectron gain** generated inside the semiconductor crystal in moving electrons as a result of electrons between electron particles and lattice electrons. This effect, while it can change crystal conductivity by many orders of magnitude, is a transient one, with the potential for accumulating when isolation is removed.

• **Crystal lattice damage**, resulting from collisions of energetic particles with nuclei in the crystal lattice, is a permanent or semi-permanent effect. Damage occurs only when the isolation particle transfers sufficient energy to the atom it strikes to move it from its original position in the lattice. This means that the amount of damage depends upon the type of isolation, with energetic protons causing far more damage than energetic electrons.

Theoretical analysis, supplemented by extensive tests, to determine the basic cause of the recently discovered surface-effect degradation, indicates that it results from surface ionization arising as or gas inside the transistor case and breaking it down into ions and electrons. Such ionization can be produced by any type of isolation particle.

Electric field produced between the

30th Inventory of Aerospace Power Issue

March 11, 1963

Never before have aerospace industry developments played such a dominant role in the shaping of world affairs. Countless millions have witnessed with excitement the momentous orbital flights... the pioneering achievements in global communications via Telstar... initial exploration of the planets by satellites like Mariner II... progress in the revolutionary supersonic transports... and official acknowledgment of the Apollo lunar landing program as America's goal. Clear understanding of these events by engineering, scientific, government and industry planners is vital to the economic welfare of our industry. As we have for the past 29 years, AVIATION WEEK & SPACE TECHNOLOGY will tackle this challenging editorial task in our March 11, 1963 INVENTORY OF AEROSPACE POWER issue.

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"Sterile" elements? Yes, but perhaps that phrase is too vague. The 1000-square-foot special facility illustrated can best be described as an integrated and built expressly to handle work requiring the cleanliness specified by U. S. Air Force T.O. 00-33-335.

State-of-the-art design combines with stringent contamination controls to make the Chandler Evans clean room one of the most efficient in industry today. Humidity-controlled atmosphere for each of its productive semi-pure cleaning, assembly and test rooms is pressurized and subjected to 93 micron filtration. Test load capability includes gaseous nitrogen and helium, as well as liquid nitrogen and carbon dioxide. From ultrasonic cleaning, macroscopic and black light inspection and plastic packaging equipment use is regular use.

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Syncom Antenna

First photo shows its transportable, 36-ft. diameter antenna built by Goodson Aircraft Corp. for use as NASA's Syncom communications satellite ground station with Defense Dept. communications satellite. Antenna can transmit and receive up to 1000 watts of power. Second photo shows antenna being lowered 12,000 ft. into orbit, according to Goodson. Synthetic device is mounted on pedestal about 10 ft. in diameter. Antenna weighs 18 tons.

collector and base of a micro-based transmitter antenna separates the negative elements from the positive ions, turning the electrons to support on the collector side of an NPN transistor, while the positive ions are attracted to the negatively charged surface of the base. On both sides, these things tend to produce reverse layers. For example, the positive ions induce an electron-rich surface layer, or channel, on the base which in effect extends the collector region out into the base (See sketch, p. 42). This contributes to the collector saturation current and if the channel extends to the emitter, it adds more current to the electrons by acting as a conducting path.

Because the collector is most transparent to electrons, it is electrically connected to the transmitter coil, when reverse bias is applied it produces a field within the coil which causes positive ions to move toward the surface of the transistor base, which increases ion collection efficiency.

Generally, the results of BTL tests tend to confirm the theoretical model which has been developed, but there are enough discrepancies and unexplained factors to show the problem is not fully solved. For instance:

- Performance degradation appears to depend more on total dose than dose rate, but under some situations the dose rate may be the determining factor.
- Polarity of transistor case, with respect to transistor base region, appears to be a significant factor affecting degradation.

In some tests but not in others. In tests using one generation transistor, degradation occurred when the case had a positive potential with respect to the base when the case had a negative potential. But in other tests, the effect was reversed. Thus there is no clear evidence whether the positive ions or the electrons produced by radiation ionization is the dominant factor in surface effects or whether both plus negative ions.

• Diffused germanium transistors in the second type tested experienced a relatively small increase in reverse collector current about 41, until the dose reached about one million rads where very drastic increases occurred. Dose levels below one million rads would cause about 10 million rads while an other group showed sharply at 10,000 rads, indicating that ionizing radiation produces greater effect on germanium. The effect of reverse bias voltage also was less than for silicon transistors.

Based on tests of a limited number of different types of transistors and diodes, BTL scientists conclude that there is wide variation in effect of ionization on degradation, even between apparently identical devices. This suggests that there is substantial degradation upon processing techniques used in manufacture and there can be considerable variation between individual batches.

Despite these results resulting from the ultra-high radiation sources produced by Syncom, BTL scientists conclude that effective screening to weed out devices particularly vulnerable to surface effects can be accomplished using low level dose of radiation. The results of these level tests can be correlated with data obtained from subsequent low-level, long-time exposure tests.



Millimeter Wave Laser

Millimeter wave laser operates at signal frequency of 96 gc (dec.) with pump laser energy of 100 gc. Infrared 10-15 gc with 200 mW laser light, according to Westinghouse Electric, which developed it for USAF's Electronics Technology Laboratory. There are no ionizing beam dose levels noted in 42K.



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TRANSCONDUCTANCE VALUES
FOR RCA-T888 NUVISTOR
Plate dissipation 0.75 Watt

The data camp-out at this chart covers a total of 100,000 iterations, randomly added to 854,744 previous iterations typical of the performance you can expect from *emcee*—as indicated by these (unrounded) mean values of integral results.

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10010

Table 10.1 summarizes the data for the randomly selected sample of 100 tubes.

Sample No.	Bacterial Concentration (log CFU/g)		pH	Total Solids (%)	Organic Solids (%)
	Before	After			
MS1-7011	11.000	11.000	7.0	1.00	1.000
MS1-7016	10.900	7.900	6.0	1.00	1.000
MS1-7050 ^a	11.200	9.000	6.5	0.4	1.000
MS1-1004	9.900	6.300	5.4	1.00	1.000
MS1-1005	14.900	11.000	6.0	0.7	0.000

¹¹ *Ibid.*, 100–101, 102.

The Most Trusted Name in Electronics

Consolidated value for the company was \$59,806,000 representing a 70% annual increase over last year, with after-tax earnings of \$4,660,000 or \$1.41 per share, compared with earnings of \$3,200,000 or \$1.00 per share in 1967. The increase was in military leases. General issued 1601 new equity shares of business assets totaling about \$14,664,000—175% increase over 1961.

Two significant items are under new management. The company's operations in the U.S. are managed by the parent, General. The company will maintain single-class common stock.

The company is in Florida affiliate, General Aviation, and has formed a European branch with headquarters at Gower International Airport, Stuttgart. The latter is to be owned by General Aviation.

• **Piper Aircraft Corp.** reports sales of \$74.5 million and earnings of nearly \$1.8 million for the fiscal year ended Sept. 30. Previous fiscal year sales were \$68.5 million and earnings of \$1.825 million. Sharp increase in earnings is attributed to increase of high startup costs incurred in 1961 at the Vero Beach, Florida, plant.

• **Boeing Aircraft Corp.,** Wichita, Kan., reported an increase of 34% in full-year sales of \$1.1 billion for 1968. Total sales were compared with the same period last year. Industries are that the company's sales in fiscal 1967 will rise to \$275.75 million compared with last year's \$67.6 million. Third quarter 1968 earnings after taxes was \$2.4 million.

Station & Month	No. of Weeks	Total Billings
Aero Commander 6000 #		
2007	1	
2008	1	\$2,500,000
Boeing 737 Series		
2007	1	
2008	1	
2009	1	
2010	1	
2011	1	\$2,500,000
2012	1	
2013	1	
2014	1	
2015	1	
2016	1	
2017	1	
2018	1	
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Note: Chicago's through freighter ranked 71st overall having a gross tonnage net 60,000 tons or slightly less compared with 84th rank with a total billion value of approximately \$90 million. The same vessel had zero

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Why this Fairchild device...



is wearing a new hat.

At Northwestern University, researchers are finding out how to make football helmets safer. To aid them, Northwestern players wore a special helmet in eight games last year. Within its lining are six Fairchild Micrologic units—complex electronic circuits in a package the size of a pencil eraser—part of a system to measure the direction and intensity of impact. The equipment frequently registered impacts as high as 300 G's—300 times the force of

gravity. To a football player, that's a lot of impact—but it's nothing new to a Fairchild device. Built to withstand factory tests as high as 300,000 G's, they're used to rough games.

FAIRCHILD
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Turbine-Powered, 10-Place Bell 204B Enters Commercial Helicopter Market

Bell 204B, turbine-powered 10-place version of the Yaw's Incopter, has entered the commercial market with Fordel Brothers Agency, Oklahoma, which is expected to sell 100 units. Four airlines will be interested in White and Co., Bell's Eugene, Ore. (AW Aug. 5, p. 75). Two others have been ordered by Incopter. Large sales and longer tail boom distinguish the 204B from the CH-18, from which it was developed. Tail boom contains baggage compartment (below left). Cabin is shown below right with seats arranged in rows of two. Door and fare door (not in view) extend Bell models for 1993 have rubber covered air wing, solid wheels. Model 4792 is modified from 1962, except for a new interior. As a result, Bell has been able to lower the price to \$200,000. Cabins for the 4792-241 and the 4792-181, right, have been reduced to 10 to 40 seats and fuel capacity has been increased from 42 gal. to 60 gal. Bell says the fuel capacity will be increased to 40% (not to be confused with 100% on each side). The turbocharged 193 also will have high speed blades with 10 ft. added to each blade tip, increased collective control and a 100 lb. gross weight increase to 2,900 lb.



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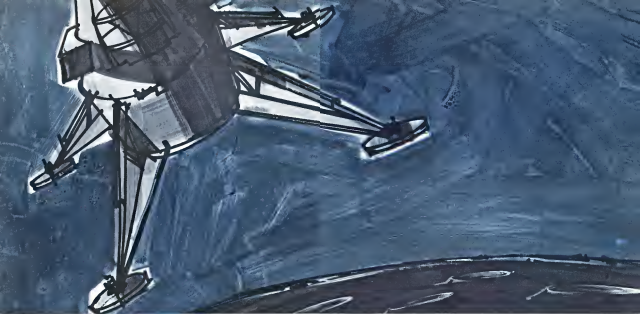
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from about 180 to around 80. "Creation of colored economic councils will help eliminate local interest trends (individualism) and discourage efforts to obtain more material resources and funds for capital construction when this is unnecessary and detrimental to overall state interests."

• **Enhancing the Communist Party's role in improving industrial production.** The party organization would be divided into two parts, one of which would be specifically charged with "leading" and "guiding" unions, checking on management and protecting state interests in enforcement. The other part would deal exclusively with agriculture.

• **Empowering workers to greater effort in establishing worker-administered committees** which would consult with management on matters of production, planning and related queries.

Khrushchev's three main "solutions" totally ignore *Anticon's* appeal for more competition. For Soviet businessmen looking over the shoulders of management and scientific and technical personnel and for greater individual initiative and freedom decisions making powers for Komsomol industrial managers.

The Soviet premier also said nothing about the need for realistic supply and demand relationships in the Soviet economy, something which *Anticon* regarded as urgent.

Monolithic Organization

In discussing the need for better technology progress, Khrushchev again asserted the desirability of monolithic organization.

"First of all, it is necessary to emphasize the interdependence of scientific research and designing organizations and to do away with the lack of cohesiveness in their work. We must introduce extensive specialization of production and stop the growth of all-purpose factories."

The President of the Communist Party's Central Committee has also avoided these questions and arrived at the common opinion that the leadership goes to scientific research and designing organizations should be consolidated in the appropriate industrial associations that it, held up in a vertical line. Only then can we be sure of following a single, unified technical policy.

The fact that this step is perfectly justified at the present time is borne out by the vast experience accumulated in the organizations of technical leadership in branches of the defense industry," he said.

"Thanks to such centralization and concentration of scientific and engineering forces in the appropriate associations of the defense industry, we now possess

the most modern weapons," he told the congress.

Obviously it is necessary to be guided by the same principles in other branches of industry, too. The leading design bureau of plants in well as scientific research and design organizations having specialized facilities should be directly subordinated to the industrial associations," the Russian premier said.

Khrushchev noted that capitalist industries, although they consider the competition "more extensive use of specialized and combined design and research organizations."

Capitalistic Competition

"Under capitalism, the introduction of new techniques in production is stimulated by competition. In order to avoid bankruptcy, capitalist firms automatically seek better factories."

"The capitalists are aware that with outdated equipment it is impossible to stand up to competition with firms using more modern equipment. If the capitalists are in this way, directed our socialist planning system can make sure we are successful use of its advantages to step up the technical progress of production to increase output and to improve its quality."

At present, Khrushchev asserted, the efforts of many industries of engineers, designers and workers are divided and clash with one another, thus slowing down their efficiency in producing the national wealth.

It stands to reason that there is no question of all of cutting out creative competition among designers for the building of the best models of machines as long as there is a combined guidelines of design work. On the contrary, broad opportunities must be created for the manifestation of creative ideas and initiative.

Slow Application

Cases of scientific and engineering achievements being given slow practical application can only be explained by big shortcomings in the practice of scientific and technological matters in the national economy.

"Contributions of design work bring the capitalists big profits. For example, in the United States automobile industry, design work and 90% of its production are concentrated in three leading concerns—General Motors, Ford and Chrysler. This is economically beneficial."

"Why don't we use everything the capitalists have achieved in material and economically profitable? We should remember the words of Lenin: 'who said we had to learn if necessary, from the capitalists and adopt everything of theirs that is sensible and useful.'" Khrushchev concluded.

GD/FW Engineering Dept. Reorganizes

Dr. Wacht—Engineering department of General Dynamics' Wacht has been reorganized into three groups: Research and Engineering, F-111 Engineering and B-56 Engineering—in the wake of the award of the F-111 (TX) contract to the company.

Company formed the organization the largest change in engineering in the history of the organization.

Robert H. Wacht, vice-president Research and Engineering, will direct the departments and coordinate under the new organization. Those are headed by J. E. Goode, director of systems technology; E. B. Maize, director of aerospace technology; H. K. Dorn, director of nuclear aircraft and dual engine; R. A. Adams, director of dual engine programs; R. H. Schmitt, director of management and technical services; and N. B. Robbins, manager of special projects.

F-111 Chief Engineer W. G. Ditch has eight major sections in his department headed by E. E. Hink, project engineer; General Aircraft Consultants; J. W. Miller, manager of F-111 tests; C. A. Seng, manager of arm and propulsion systems; M. F. Hines, manager of systems systems; E. H. W. Maize, manager of aircraft design; M. E. Aldrich, manager of engine and engine; E. M. Hines, manager of support organizations; and G. G. Schmitt, manager of support equipment design.

B-56 Chief Engineer D. R. Kai will have in his department sections headed by G. M. Hines, manager of arm and propulsion systems; C. E. Goode, manager of systems systems; W. N. Stevenson, manager of aircraft design; D. L. Bechtel, chief of planning and controls; R. J. Zwart, chief of test programs; and J. B. Maize, chief of engine engineering.

Lack of Maintenance, Parts Cited by GAO

Washington—Purchase of Army and Navy combat and training units in the U.S. and overseas has been "seriously affected" by lack of maintenance and replacement parts due to inefficient internal handling, according to a report to Congress by the General Accounting Office.

The report is directed at the Army and Navy policy of allocating "customer funds" to combat units for the purchase of consumable parts and on total loss control stock fund investments. This was intended to cut waste. The Army-Navy Joint Chiefs of Staff commander funds for the purchase of parts—instead of allocating the actual parts—by being re-used by DOD.



**This can be your
cryogenic cleaning facility!**

... the same facility used in cryogenic
cleaning of Flexonics earcaps and
ground support hardware



Kaiser Kardon lounge door is made of translucent glass like panels mounted in 12 in. aluminum framing. Doors weigh approximately one quarter as much as doors made of other materials, the manufacturer says.



Tumalacore, when the problem of interior lighting during daylight hours and light-tight facilities. Handling, the manufacturer says. All trucks, busses, boats etc. are galvanized steel. Boilers are built bearing and exterior look are as steel.


Raven Mfg. Co., Dixon, Ill.

Ultrasonic Cleaning System

Biostatic solid state ultrasonic system for small parts and components cleaning has 500 w. average and 600 w. peak, dual frequency transducer generator.



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NEWSWEEK Sept. 24, 1978 Thurs., Section 2 (Class)
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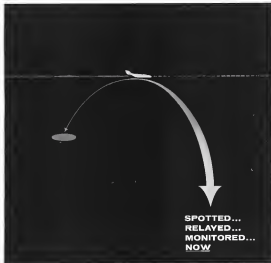
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- No 3 tank and both No. 4 tanks-off orbit.
- No 3 tank open-DIFF, but the cockpit suggested that both side windows were jettisoned in its crash.
- No 5 tank (outboard) and both No. 2 tanks-off GN.

Crashing into The opening first consisted of this pilot—a captain and two first officers. The captain in LFA threw away the left seat while the third pilot sat at the large instrument panel behind the cockpit.

Post-mortem examinations revealed no signs of pre-crash disease or impairment in any of the three operating crew.

Confession as the wreckage dived at first only the top stages of three older Inverness rcs, instead of eight.

Captain R. J. Raddcliffe
Date of birth: June 10, 1917
Date of employment: June 27, 1946
Active Transport Pilot's License: No. 73467 (expiring June 15, 1962)
Total flying hours on C-54: 797
Date of promotion to REA, June, 1955
as Senior Captain.

The physical examination and proficiency checks are current.

First Officer C. M. Bell
Date of birth: Nov. 1, 1917
Date of employment: May 15, 1946
Active Transport Pilot's License: No. 64132 (expiring May 15, 1962)
Total flying hours: 7,237
Total flying hours on C-54: 577
Date of promotion to REA, November, 1961
as Senior Pilot Officer.

The physical examination and proficiency checks are current.

First Officer F. McBrack
Date of birth: Oct. 7, 1915
Date of employment: May 24, 1952
Active Transport Pilot's License: No. 55771 (expiring Feb. 28, 1962)
Total flying hours: 7,485
Total flying hours on C-54: 540
Date of promotion to REA, July, 1959
as Senior Pilot Officer.

The physical examination and proficiency checks were current.

Nonfatal odds All the ground was equal and safe and radio-telephone checks were checked after the accident and were found to be functioning satisfactorily. The ILSS was not operational and had been out of use for some time.

Study of the accident site The ground at the scene of the accident sloped up at an angle of two to three degrees and the accident struck on a shoulder of 150 deg. angle on a road with the left wing

down and the fuselage profile in the ground. The nature of the damage, the angle of the ground and the depression of the accident site suggested that the aircraft had a low forward speed coupled with a high rate of descent at the moment of impact.

The left wing leading edge, lower wing structure and main landing gear were off the ground at first impact. Almost immediately the nose, which was forward and had broken away the ground. The right wing dug into the ground about 90 deg. was down 120 ft. forward of first impact. The aircraft had been on its belly, being up in the process and came to rest after about 500 ft. of ground.

The main wreckage consisted of the forward fuselage, center fuselage and main wing with the cockpit at the corner of the main wings attached. The rear fuselage, aft of main, was completely detached but had come to rest about in its correct relative position. Both fuel and main gear had broken in the center system allowing the right wing to dig up back. It is concluded that both these failures and the detachment of the rear fuselage occurred at initial impact.

There was no evidence of any fire in the wreckage. The fire was apparent in the late stages of the wreckage but had been out and on the No. 1 tank was spreading fire and air through the fuselage and over the No. 2 and 3 tank area of the left wing. The right wing was not burned.

The flight line ground was using a scheduled public transport flight from London to Tull AFB. It had left London under the same air and had left off the runway and landed. The flight was operated by REA on behalf of Cyprus Airways. Captain Raddcliffe and his crew took over the aircraft at London on its arrival to Tull AFB, Nether and Tull AFB. The title of the flight was the flight to London and the landing at London was off course. The flight was operated at London in the air and had been taken on at London for the new service to London but the continuity of the service continued until the moment of the accident by a REA member.

The issue between landing and saving aspects at London was 40 min. During this period light snow was falling and the engine was supervised due to the air supply volume of the aircraft and engines. No decision had been made but the engine of the engine was continued until the ground was broken to the ground. The approach of the

ENGINEERS & SCIENTISTS in the fields of space vehicle power and propulsion

The Propulsion and Power Systems Department for Aerospace Vehicle applications has several unusually interesting openings for engineers and scientists who are interested in the fields of space vehicle power and propulsion. The openings are at all levels of experience—both recent graduates to the senior staff level. Most of the positions will involve design and analysis of power and propulsion systems for satellite and space probe applications. Specifically, some of the areas of specialization are:

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Weather	Cloudy	Clear
Cloud	6/8 miles at 500 ft.	5/8 miles at 500 ft.
	1/4 mi at 2700 ft.	5/8 mi at 2700 ft.
	5/8 mi at 7000 ft.	5/8 mi at 7000 ft.
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tailfinest nose not swept to the rearward, after inspecting it, decided that the nose lifting on it was nothing upon contact. The elevators were swept in a position against water running into the hinges and perhaps leaving there. Transportation at the time was AC and the nose was supported to be resting on the spruce, however and repair.

The radio-telephone tower revealing that the aircraft would not along the shore, however, due back to the nose on the runway to its take off position on January 21 at the airfield with the target tower. The surface wind was gusty at 10 knots and the visibility at 2 km. The runway length available from the position was 5,827 ft. (1,815 ft.) below the runway threshold, weight, or 1,815 lbs. below the required threshold weight. At the time of both testing out and take off there was a light coming of water on the upper surface of the wing.

The take off run at its own weight and time was quite normal as the water came and splash. The first abnormality occurred a second or two after which when the aircraft rapidly entered an excessive steep climb angle—some writers put the angle when it came from the normal, another at 45 to 50 deg.

There was also evidence from witnesses of a wing drop and a variation in the nose area during the climb. The aircraft, with the left wing down at a height of about 450 ft., then sank to the ground in a relatively flat position.

After the accident a narrow inspection was made. The water had 0.5 cm of snow on it which was made of runway objects over 10 ft. in diameter. There were no wind marks on the runway or on the same lands and nothing abnormal was seen or found.

Full review. The evidence obtained after the accident showed that:

• Before starting engine at Anken, the No. 3 (upper) tank contained 700 gal and the No. 1 (lower) tank contained 185 gal.

• None of the booster pumps for either of the No. 4 tanks was checked ON.

Calculations made by the de Havilland Aircraft Co. suggested that in three conditions and at a low speed would be a means of the engine, the pump in the No. 3 tanks could have been started and the fuel flow in No. 1 and 4 engines could consequently have been interrupted, in coming a power loss in those engines.

The switching on of two booster pumps on each No. 4 tank but to be done more directly before lift-off.

The drill cards were not adequate to ensure that this was done.

Analysis

Whether the position of the suspect pump in relation to the engine, the fact that the aircraft did not begin to ascend an abnormally steep climb attitude until a second or two after which, and the fact that the landing gear was not extended up, together give a strong indication that something unusual occurred immediately after lift-off. From which the aircraft entered an abnormally steep climb angle, which rose to about 45 deg, that a short time before the normal before a stall. The exact sequence of events and the action of the crew during the brief flight cannot be established. The only fact is the aircraft and its component that could account for the abnormally steep climb was the disturbance of the pitch position in the engine throttle barometer.

It is believed probable that the engine (which at this moment) the aircraft was in position immediately after which and along the pitch position only about half way to the normal upward position on the pitch scale, applied more or elevator. Although this would have it once happened but during this would have been no indication of a



ASW EFFECTIVENESS

A new ASW system now under development in England is designed to maximize the U.S. Navy's ASW effectiveness through data processing, control comparison, sensor integration and automatic recognition.

Urgent and immediate requirements for this program for the Navy and the ASW effectiveness through data processing, control comparison, sensor integration and automatic recognition.

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First C-141 Transport Fuselage Section Completed

Forward fuselage section of the USAF Lockheed C-141 Starliner transport project is being built from the production plant at Marietta, Ga. Section was in production five months. It is 35 ft. 8 in. long. Total aircraft length will be 143 ft. First prototype is scheduled to fly later this year.

PROBLEMATICAL RECREATIONS 154



Noel Minnoworth-Langmore, the famous Oxford swimmer, was missing upstream one Sunday when his favorite rowing cup fell in the water. So absorbed was he in one of Hesse's poems that it was two minutes before he discovered his cup missing. He turned around and recovered the cup one mile downstream from where he was only ten ft. Assuming constant speed, and no allowance for time around, how fast was the river flowing? —Concluded

Advance your career as electrical systems by investigating career opportunities at our Guidance and Control Systems Division. We're looking for engineers to contribute to the development of our advanced gaseous inertial navigation and our auto-inertial-doppler and inertial-doppler systems. If you know your way around an inertial guidance and/or airborne digital computer and associated electronic equipment, write to Mr. J. T. Lutz. Your reward will beag immediate action.

ANSWER TO LAST WEEK'S PROBLEM: $N = (9 + 2) \cdot 41 \cdot 50 = (11) (24) (130) = 31,680$

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WHO'S WHERE

(Continued from page 25)

Honors and Elections

Dr. Charles F. Gelf, manager of Life Sciences for Chance-Vought Associates Division of Long Beach-Vought, has been appointed to the Department of Defense newly established Advisory Panel on Medical and Biological Sciences.

Changes

Dr. D. Robert Lennarz, manager, Research Division, Alpien Industries, Los Angeles, has been promoted to president.

William F. Gandy, purchasing manager, Harshman Standard Division of United Aircraft Corp., Whittier-Lockheed, Conn., and Richard P. Sprague, factory manager.

T. R. Ennis, manager of service engineering operations for the control and guidance systems of General Electric Co. a Defense Programs Operation, with headquarters in Dayton, Ohio.

Frederic G. Feilberg, research director and leader of transportation, Biomechanical Research, Inc., Washington, D.C., and Charles E. Laffey, research director, electronics and communications.

General Dynamics/Instruments, San Diego, Calif., has announced the following appointments: J. H. Johnson, Director Management Systems; J. M. Harty, assistant to the vice president advanced systems; R. B. Quinn, manager, Material Cost and Administration.

Dr. Thomas R. Weber, manager, Bio-Instrumentation Space Engineering Group of Bellman Instruments Inc., Pasadena, Calif., Charles F. Wynn, head of the newly established St. Louis, Mo., office for Chance-Vought Co.'s Military Aircraft Division.

London E. Pines, director of manufacturing, Transcend a division of Laboratory For Electronics Inc., Waltham, Mass., and James F. McGee, manager government contracts marketing.

Lockheed Missiles & Space Co., Palo Alto, Calif., has named the following as new members of the Mathematical and Mathematical Sciences Research Laboratory: Dr. Robert J. Dwyer, Dr. William S. Johnson, Dr. James H. Klumpner and Thomas F. Mikolajewicz.

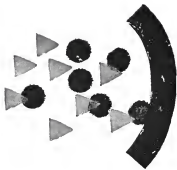
William F. Redwood, executive director of Electronic Laboratories for Systems Electronic Systems, a division of Systems Electronic Products, Inc., Bedford, N.H.

William F. McGee, manager of advanced projects, Marshall Laboratories, a subsidiary of Marshall Laboratories, Torrance, Calif. James R. Brown, chief, Communications, Satellite Programs Field Office, Defense Communications Agency, Fort Monmouth, N.J.

Yngve S. Thorsen, senior consultant, Systems Programming Center, Berkeley, Calif.

Dr. F. B. Brooks, manager of the newly formed Research and Development Department of Trans Electronics Division of Long Beach-Vought, Inc., Gardena, Calif.

Richard H. Poy, director of systems engineering and integration for Lear Siegler, Inc.'s Space Systems Division, San Francisco. Thomas Thompson, special projects manager, Systems Engineering Department of Systems Dynamics Corp., Concord, Calif.



Said Michael Faraday: "The amounts of different substances deposited or dissolved by the same quantity of electricity, are proportional to their chemical equivalent weights."

Increasing requirements for pure, very thin films—especially those of ferro-magnetic elements and alloys—have become critical. To break this bottleneck, one production method under investigation is a chemical process from an aqueous solution—using metallic salts and a reducing agent.

Scientists of Lockheed Missiles & Space Company have conducted some highly successful experiments, in which extremely pure and thin ferro-magnetic films was deposited on such material as glass and plastics.

This film deposition is but one of many phenomena now being investigated at Lockheed Missiles & Space Company in Sunnyvale and Palo Alto, California, on the beautiful San Francisco Peninsula. Engineers and scientists of outstanding talent and ability naturally gravitate to Lockheed. For here they can pursue their special fields of interest in an ideal environment.

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DESIGN ENGINEER. Supervise and/or generate design proposals for support in electronics, structural, stress and systems. Also design the actual systems analysis, selection and reports the aerospace major systems. MS degree. 7-10 years in design of aircraft/aerospace structures.

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